THE ASSEMBLY OF PRODUCT DESIGN TEAMS: DO TEAM ASSEMBLY MECHANISMS SHAPE TEAM CONFLICT AND VIABILITY?

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Kathryn Dalrymple

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THE ASSEMBLY OF PRODUCT DESIGN TEAMS: DO TEAM ASSEMBLY MECHANISMS SHAPE TEAM CONFLICT AND VIABILITY?

Approved by:

Dr. Leslie DeChurch, Advisor
School of Psychology
Georgia Institute of Technology

Dr. Wendy Rogers
School of Psychology
Georgia Institute of Technology

Dr. Bruce Walker
School of Psychology
Georgia Institute of Technology

Date Approved: March 30, 2015

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SUMMARY

The decisions behind choosing teammates for an interdisciplinary team are significant. Team assembly – the reasons behind individuals' decisions about whom to work with in teams – likely play a key role in shaping crucial team processes, such as conflict and viability. This thesis advances a two dimensional taxonomy of team assembly where member decisions of who to team up with can be: (1) driven by team maintenance or task performance concerns (i.e., team versus task), and (2) based on individual characteristics or dyadic relationships (i.e., compositional versus relational). The effect of these four assembly mechanisms on resulting conflict and viability perceptions were tested in a sample of thirty-nine design teams enrolled in a master's level human-computer interaction course (over three years). Within each of three cohorts, individuals self-assembled into project teams to develop a product that would better lives in some way. Relational team assembly was measured at week 1, compositional team assembly was measured at week 2, team conflict at week 5, 10 & 14, and team viability at week 14 using surveys. Hypotheses were tested using exponential random graph models to predict conflict tie formation based on dyadic assembly rules, and regression to test if relational team assembly mechanisms predict team viability. Results indicate that taskwork assembly mechanisms predict team conflict, but teamwork assembly mechanisms do not. Relational teamwork and taskwork assembly mechanisms do not predict team viability. Future directions of research in team conflict, team assembly, and team networks are discussed based on the current findings. This thesis contributes to science by providing an interdisciplinary model of team assembly mechanisms, and evaluates the model in explaining team conflict and viability.

CHAPTER 1

INTRODUCTION

The prevalence of teamwork in organizations has increased considerably over the years. Modern teams often include members who are geographically distributed (Bell & Kozlowski, 2002), drawn from different disciplines or functional areas (Ancona & Caldwell, 1992), interacting virtually (Townsend, DeMarie, & Hendrickson, 1998), and together for very short or very long time frames (Joshi & Roh, 2009). They can be created to solve an immediate problem and disband, or remain intact and continuously work together. A particularly important and less well understood team type is the self-designed team (Hackman, 1987). These teams choose their own teammates; no one is assigned to this team. Self-designed teams could be completely self-chosen, with individuals coming together to form a new team, or be partially self-assembled, where a pre-existing team is choosing a new person to join the team.

Self-designed teams are the backbone for a great deal of scientific and organizational endeavors (Guimera, Uzzi, Spiro, & Amaral, 2005). These teams can be found in a variety of work settings, such as R&D departments, academic research, the entertainment industry, and entrepreneurial startups, just to name a few. Whereas the factors that determine how and why a team is formed likely play an important role in shaping important team processes or states (e.g., conflict), or subsequent outcomes (e.g., innovation), little research directly explores the reasons why individuals choose certain teammates, and the consequences of their choices on the functioning of the team.

Traditionally, teams' researchers begin studying a team once it has already formed. This includes studies of teams that were formally staffed, or teams that were randomly assigned by researchers; these teams are characterized as self-managing or manager led teams (Hackman, 1987). Research on self-designed teams has received little attention, despite their prevalence; the key difference between self-designing and self-managing teams is the agency of team members to choose their teammates. Team assembly is the process of choosing teammates and ultimately forming a team. Team assembly mechanisms characterize the reasons why individuals choose one another, and do not choose others, to work with.

The first core idea of this thesis is that *the functional needs of the team drive team assembly mechanisms*. For example, choosing to work with familiar or similar individuals meets individuals' need to get along in the team. Choosing competent teammates, or teammates with particular skills, meets the team's need to get ahead. The needs to get along and get ahead are definitional to a team. These have been variously labeled, but researchers have long agreed on a two-dimensional structure. The need for teams to get along refers to the need for positive interpersonal relationships (Brewer, 2010; Marks, Mathieu, & Zaccaro, 2001), social functioning (Bales, 1950), and meeting basic needs for affiliation and trusting in-groups (Baumeister & Leary, 1995; Fiske, Cuddy, & Glick, 2006). The need for teams to get ahead refers to their task needs (Bales, 1950) and goal directed behavior (e.g., transition and action processes, Marks, Mathieu, & Zaccaro, 2001).

These needs are a useful starting point for thinking about why people choose particular teammates and not others, and what information people attend to when selecting teammates to work with. Does she have desirable skills? Is he a team player? Have we worked together before? Questions like these are the basis of assembly mechanisms. The second core idea of this thesis is that these *assembly mechanisms can have lasting effects on how a team functions* and performs (Owens, Mannix, & Neale, 1998). What if employees only chose teammates that were similar to them or well-liked without regard to their ability to complete the team task? How would this affect team processes or outcomes? This thesis fills an important gap in current research by exploring the nature and outcomes of team assembly.

Contributions of the Present Study

The formation of self-designed interdisciplinary teams is on the rise in a variety of organizations, but little knowledge is available about how their creation process affects resulting team behaviors and outcomes (Guimera et al, 2005; Jones, Wuchty, & Uzzi, 2008). The contributions of this thesis are twofold: (1) Develop a conceptual model of team assembly mechanisms rooted in team functional needs; (2) Empirically test team assembly mechanisms' relationship with team conflict and viability.

This thesis contributes to both theory and practice on teams. With regard to theory, this thesis will advance our understanding of the core relationships between aspects of team formation (i.e., the extent to which individuals choose their teammates based on compositional and relational taskwork or teamwork factors) and the conflict that emerges within teams. On the practical side, this thesis could have implications for the staffing of teams. Moreland (1987) noted how social psychologists often study groups, but fail to explore group formation and that "this neglect is unfortunate, because research on the formation of small groups could yield important benefits" (p. 80). Over 25 year later, we still know very little about team formation, but now organizational psychology will take the lead in this field of research.

Team Assembly Research Literature Review

Research on team assembly is a budding field, with researchers trying to explain teammate selection choices in a variety of contexts such as project teams (Cummings & Kiesler, 2007; Hinds, Carley, Krackhardt, & Wholey, 2000), sports teams (Pinto, 2008), and open source software teams (Hahn, Moon, & Zhang, 2006). There are similarities between the mechanisms utilized in each study, but there is no overarching theory that might link these mechanisms together. Hinds et al. (2000) chose mechanisms that aim to reduce interpersonal uncertainty on the team (familiarity, homophily, reputation for competence). Cummings and Kielser (2007) have similar mechanisms that aim at increasing the likelihood of individuals working together (familiarity, proximity, and homophily). Hahn et al. (2006) hypothesized only relational ties would predict team formation in open source software teams, because there is no incentive or obligation to be on those teams. The aforementioned studies include only relational assembly mechanisms, but Pinto (2008) goes beyond that and also includes teamwork and taskwork mechanisms into his model. His three-mechanism model is a departure from the previous, by including non-relational mechanisms to explain individuals reasoning for choosing others as teammates. These studies are a sampling of the diverse conceptualizations in team assembly research. Overall, there is a need to organize what is known, and to go one step further by understanding the relationships between assembly mechanisms and team processes.

One glaring omission from many team assembly studies is the effect of team assembly mechanisms on team functioning or performance. Often times the way mechanisms are conceptualized or measured impede researchers from examining the effect of team assembly. If the team is not completely self-formed (e.g. a leader makes the final decision) or if only information on teammate preference is gathered but not the motive on choosing that teammate, it becomes impossible for team assembly mechanisms to explain team effectiveness. This thesis will take the extra step, and explore team assembly mechanism's relationship with conflict and viability. What draws people together as teammates has possible implications for the type of conflict experienced within the team, as well as if the team is willing to work with each other in the future.

Current team assembly research often draws from social psychology and network science. Social psychologists have long studied a variety of constructs that are relevant to team assembly in self-designed teams, such as team composition, attraction, and group formation (Bell, 2007; Bell et al., 2011; Byrne, 1971; Byrne & Nelson, 1969; Joshi & Roh, 2009; Lazarsfeld & Merton, 1954; McPherson, Smith-Lovin, & Cook, 2001; Moreland, 1987). Network scientists have begun to develop theories of team assembly mechanisms and conduct empirical studies (Contractor, 2012; Guimera et al., 2005). These network-based theories are heavily based on principles of complexity in systems and less on the motives of an individual to choose someone as a teammate. Many team assembly studies take an interdisciplinary approach, marrying social psychological concepts and network concepts to understand why people choose certain others as teammates. Before reviewing the current literature on team assembly, an overview of relevant psychological and network science research is needed to understand the basis of team assembly research.

Psychology Informing Team Assembly

Despite no prevalent theories or serious programs of research about team assembly, psychological research has many pertinent concepts to explain team assembly mechanisms. To start, team composition literature focuses on the diversity (or lack thereof) of teammates in terms of surface or deep level variables. These variables could be about the individual (gender, personality, etc.) or about the task (skills, tenure, job position). From this research, the general consensus is that diversity of the team does affect the functioning and effectiveness of the team (Bell, 2007; Bell et al., 2011; Joshi & Roh, 2009). Thus, who is on your team does matter and the choices that individuals make when choosing teammates are important to understand. Therefore, we must understand the driving forces that attract individuals as teammates.

Attraction theories are instrumental in understanding the underlying motives people use to choose teammates. Often, people are attracted to those that are similar to them. This is a principle known as similarity-attraction or homophily (Byrne, 1971; Byrne & Nelson, 1969; Lazarsfeld & Merton, 1954; McPherson, Smith-Lovin, & Cook, 2001). A classic study conducted by Newcomb in the 1960s is a perfect way to illustrate this point. Newcomb studied the formation of subgroups within a sample of students all living in the same dormitory. Students tended to form groups with people who shared similar interests, values, and beliefs. So when given the option of whom to socialize with, students tended to choose others who were similar to them in individual characteristics. In the context of teams, it is believed that people most often use homophily principles when choosing teammates because of the attraction between similar individuals (Finkel & Baumeister, 2010; Forsyth, 1999; Hinds et al, 2000; McPherson, Smith-Lovin, &

Cook, 2001). Attraction theories work for any situation, including during formal and informal group formation.

Group formation research is the precursor in social psychology to team assembly research. Many early psychologists wanted to understand why people formed groups. The groups psychologists were curious about were not often found in organizations but in social settings, such as church groups, school groups, gangs, etc. Often people formed groups to fulfill a need to belong (Baumeister & Leary, 1995; Smith, Murphy & Coats, 1999), to be affiliated with a certain group of people (Festinger, 1950; Festinger, 1954), or for survival (Moreland, 1987). In a team setting, there is a purpose to form the team (if there was no goal for the team to achieve then there is no need to form a team), so what can be pulled from the group formation literature is what might compel others to become teammates with certain individuals to form the team. Within groups, people have a desire to fulfill a social need but within teams there is the added constraint of needing to accomplish a goal. Thus, team assembly choices are impacted by the social and work related needs of the individual.

Balancing the social/work dynamic within groups and teams is a prevalent issue with psychological research. In the 1950s, Bales (1950), a social psychologist, described group interaction as being task or social/emotional in nature. When studying groups, he would code verbal and nonverbal interactions between group members, and assign a behavior to a particular category, social-emotional or task. He described social-emotional interactions as showing solidarity, tension (or tension release), or agreement (or antagonism). Interactions of giving or asking for opinions, suggestions, or information fit into the task category of interactions. The task versus social taxonomy has expanded beyond group interaction theory posited by Bales, and now describes leadership (Burke, 1971; Fiedler, 1978) conflict (Guetzkow & Gyr, 1954; Jehn, 1995), and team dimensions (Hackman, 1987). Fiedler (1978) developed the contingency theory of leadership that assumes leaders take on a task-oriented (planning, giving feedback, coordinating action) or a relationship-oriented (manage conflict, show concern, increase cohesion) style of leadership.

Hackman (1987) advanced the notion that the social aspects of working in groups are just as important to consider as the abilities of group members to complete a task. At the time, much research focused on the characteristics of the job, with little mention of the impacts of social relations. He theorized two types of interventions that help promote group effectiveness: structural interventions that detail how group members should complete a task and interpersonal interventions that improve group member relations. These two interventions alter the attitudes group members have and the way they behave toward each other, and are best used in already established teams.

Psychological research provides an understanding for how people form and work in groups, and two themes emerge from this literature: the person and task. The characteristics of the individual in team composition, homophily, and some group formation theories center on what is it about a person that affects team processes. The task-related abilities of individuals within a team and forming a group to achieve a goal highlight what it is about a person's ability to complete the group goal (whether it be a team organizational goal, or a church's social goal) that affects team processes. Thus, psychological research suggests that taskwork and teamwork are two mechanisms for team assembly that could potentially explain variances in team functioning.

Network Science Informing Team Assembly

Network science seeks to understand the relationships among entities and the network those relationships make. Theories explain how relationships form as well as how those relationships impact other factors. Network theories and methodology are the basis of this thesis because I seek to understand how the teammate relationship forms and its consequences. A network consists of nodes and ties. Nodes are a set of actors and ties are the relationships between nodes; in this thesis, my network consists of nodes as potential teammates and ties as teammate relationships. Ties between potential teammates can form for a variety of reasons, thus the reason for a tie forming is the assembly mechanism. Network scientists often explain teammate ties forming due to structural signatures within a network. These signatures shape the network and the way ties form within it. An example of a network signature is the triangle effect. For example, if person A is a friend with person B and person C (having ties with B and C), the triangle effect states that person B and C are likely to be friends (have a tie with each other). Thus, just because of where certain ties exist (and no other reason), other ties are likely to exist. Network science also considers the dependency between ties, such that once person A and person B becomes teammates, this influences the next person who joins the team. All possible teammates are never in a complete vacuum. The teammate relationships that exist impact the teammate relationships that will form. Person A and B are friends, so they decided to be teammates, but Person D joins person A and B’s team because she has skills the team needed. This example also illustrates that different mechanisms can be used to form the same team.

In the last decade, there has been increased interest by organizational psychologists in network science, which has also bred interest among network science in organizational psychological concepts. One group of researchers were interested in how successful teams formed using a sample of science and Broadway teams. Guimera and his colleagues (2005) created a model for team assembly based on three parameters: team size, the probability of selecting incumbents (people who already belong to the network), and the propensity of incumbents to select past collaborators. They focused on how these parameters led to a larger collaboration network, and how those parameters influenced success in teams. This large, clustered network creates an invisible college: a network where individuals access an expansive and diverse knowledge. Successful teams have a higher fraction of individuals who belonged to the network longer, as well as a mix of new and previous collaborators. This influential article brought attention to the study of team assembly with networks, but one key issue is the motivation of individuals to select previous collaborators or certain incumbents is not known. There is a loss of information that may have further explained the results.

Following Guimera and his colleagues' article, additional research expanded to further explain team assembly mechanisms. Contractor (2012) developed a networks-based team assembly framework called the Multi-Theoretical Multilevel (MTML) model. This model uses the properties of individuals (skill, role, resources) as well as the links between individuals (financial transactions, communications, services exchanges) to explain why people form, maintain, and dissolve teams. This theory has eight families, or forces, that describe why people choose teammates. Each family has a corresponding network structure signature to explain the relationship. The first family, theories of self-interest, explains team formation as a way to achieve personal goals. Second is a theory of mutual interest and collective action, which explains team formation as a means to accomplish a goal that an individual cannot. Third is a theory of contagion, meaning people would join a team because others in their network have joined the team. Fourth are cognitive theories, in which people join a team because they think others on the team have resources they require. Fifth are exchange theories, where people join a team and provide resources they possess in exchange for resources their team members possess. Sixth are homophily and proximity theories, in which people form teams with those who have similar attributes or are in close geographic proximity. Seventh are balance theories, where people are more likely to team up with friends of friends rather than strangers to keep their network consistent. The eighth family, co-evolutionary theories, states that people join a team because they believe being in a team will increase their "performance, survivability, adaptability, and robustness" (Contractor, 2012, p. 10). This approach is a thorough and very complex way of identifying team assembly mechanisms. The reliance on explaining team assembly through structural signatures makes the theory lack, at times, an understanding of the motives within an individual to choose another individual.

Contractor (2013) followed up the Multi-Theoretical Multilevel model with a more simplified approach. Figure 1 shows his new model of four mechanisms for team assembly.

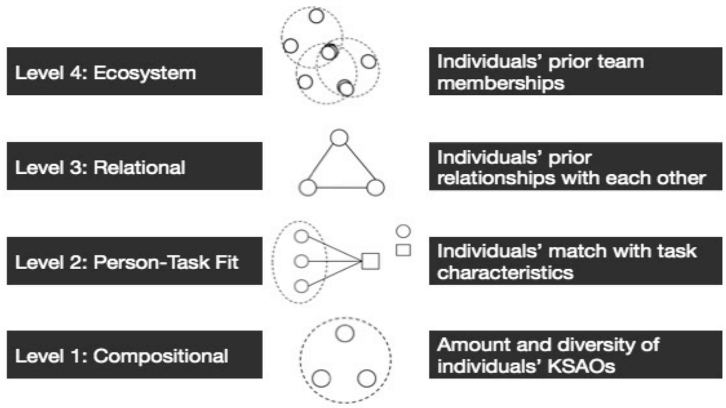

Figure 1. Four levels of team assembly mechansims. Adapted from "Some Assembly Required: Organizing in the 21st century," by N. Contractor, 2013, *Presentation at the Fifth international workshop on network theory: Network science meets the science of teams*.

Contractor did not abandon the MTML model for these four mechanisms; rather each of the eight families falls into one of the four mechanisms, or levels. Level one is the compositional level, which are the individual differences between potential teammates as drivers of teammate selection. Level two is an individual's match with task characteristics, meaning how suitable a potential teammate is for the accomplishment of the team goal. Level three describes choosing potential teammates because of the previous relationships you have with that individual. Level four describes choosing potential teammates because of the previous team memberships of that individual. Contractor's (2013) four levels of team assembly is a great start, and to move forward in team assembly research the work of Contractor (2012, 2013) and Guimera et al. (2005) need to be expanded to include more psychological concepts into team formation. They do not go deep enough to understand the different types of motives individuals have when choosing teammates. A tie could form between individuals on a team that follow the network structures described by network theories but the ties could be valued differently, such that a teammate tie forms because of the competency of the individuals or a teammate tie forms because the individuals were friends. There is a need to understand the underlying motive of the tie formation. Current research on team formation has attempted to explain motives for teammate selection using both a psychological and networks approach.

Current Team Assembly Research

In the last decade, a small number of articles have been published on the topic of team assembly, though few use the term. The majority are in the exploratory stage; with theory guiding them, researchers try to see what mechanisms people use to form teams. Some people question team members for why they choose a teammate (why a person believes they chose a teammate); others examine the composition of the teams to find patterns (how a person actually chose a teammate). The latter is inherently interesting to understand how people actually assemble into teams, but to hypothesize relationships beyond assembly would be the same as team composition research. Thus, this thesis focuses on the first question, or why a person believes they chose a teammate, and the effects of that decision.

Hinds, Carley, Krackhardt, and Wholey (2000) take a multidisciplinary approach, pulling from social psychology, sociology, and network theories to create a framework for understanding why individuals choose others as teammates. They noticed a lack of attention to actual work tie relationships in current relational research, with much emphasis on friendship or advice networks within an organization. To remedy this, their study sought to understand how people choose teammates, with a focus on individual and relational attributes. Their mechanisms of homophily, reputation for competence, and familiarity are based on reducing uncertainty in the team. They posited that people would choose to work with others who were similar to themselves (homophily), except in regard to actual skills required to complete the task. The expectation was that people would choose others who had complementing skills to their own, as well as people who have skills that are relevant to the group task (reputation for competence). Hinds and her colleagues also believed that people would prefer to work with others whom they worked with in the past, especially if the past relationship resulted in a successful outcome (familiarity).

Overall, they found modest support for their hypotheses. In regards to homophily, only one of the three demographic measures had a significant effect. People were more likely to form a team with those of the same race. There was also no effect in regard to choosing individuals with complementary skills. However, there was an effect for reputation for competence, meaning individuals were more likely to choose teammates who had previously displayed competence for completing the team task. Interestingly, race is still a significant predictor when competency is added to the model, thus people are likely to choose someone of their own race and has a reputation for competency. Familiarity is slightly related to teammate choice. In this study, familiarity was significant when in the model alone, but the results became muddled once other factors were added.

What Hinds et al. (2000) did not show are the participant's reasoning for wanting to work with a particular teammate. Participants were only asked who they wish to work with, the researchers infer why based on the information available to them. In reality, these participants did not actually self-assemble either; they were placed in teams based on their teammate preferences. Thus, the assembly mechanisms are not the participant's perceptions of why they chose someone, but rather based on the actual characteristics of the participants. Due to this limitation, it is not possible to assess whether these mechanisms affect team functioning or performance.

Research following Hinds et al. (2000) includes similar assembly mechanisms. Casciaro and Lobo (2008) examined who people preferred to interact with at work, with competency and liking as potential reasoning. Their findings uncovered an interesting, albeit obvious, relationship: people prefer working with those they like, including when seeking out someone competent. Individuals only consider competent individuals they like, not competent people they dislike or felt neutral about. Hahn, Moon, Zhang (2006) explored mechanisms in open source software (OSS) development teams, where there are no formal boundaries or incentives to work on a team. The key assembly mechanism they found was previous collaboration. The existence and amount of prior collaboration ties increased the likelihood a project would attract developers, and if a developer has prior relationships with the project initiator it increases the probability the developer will join that project. Here, prior relationships mean working on an OSS project together previously. Considering OSS teams are not bounded within in an organization and are open for anyone to take part, it is possible relational ties are the only predictors of team formation for OSS teams. For teams within organizations, relational mechanisms may not capture the whole picture. Teams have clear goals to accomplish for the organization, so the team must be able to work together and complete the goal.

Pinto (2008) proposed three mechanisms for team assembly: taskwork, teamwork, and relational. From a group formation standpoint, these mechanisms are the most relevant. They capture the reason why people are coming together (taskwork), the ability to work together (teamwork), as well as the social reasons people are drawn to one another (relational). In his dissertation, Pinto (2008) used these mechanisms to understand sport team formation. In this particular case, a leader (the coach) was the one selecting all of the teammates. Those selecting teammates considered the taskwork and teamwork abilities of potential teammates, but Pinto found that a person's relational ties biased the team selection process as well.

In all, current team assembly literature has shown that people choose teammates for a variety of reasons: people of the same race, competency, liking, and previous work relationships. When considering the actual findings, a more complex framework emerges than what Hinds et al. (2000) originally conceptualized. Rather than homophily, people may choose others who they feel they can work well with. Being of the same race may signal that relationship. Competency is a central aspect of the mechanism taskwork, as competency signals the ability to complete the team goal. Previous work relationships are one aspect of a more encompassing mechanism of relational ties, or the social reasons for choosing someone as a teammate. Liking someone signals to the individual a potential cohesive teammate. Choosing teammates is a conscious process, and it is tenable that individuals attend to all of this information when selecting teammates.

Contrasting Team Assembly with Related Theories

Before moving on, it would be remiss not to examine how team assembly is different from related literatures such as self-managed teams, team staffing and team composition. Due to the similarity of these concepts, the differences should be elaborated. Depending on the type of team, the responsibilities of accomplishing the team goal may lie with the team or management. Hackman (1987) described three different team designs: manager-led, self-managing, and self-designing. Thompson (2011) added a fourth design to Hackman's model, self-governing. The two most commonly researched team types are the manager-led and self-managed teams. Manager-led teams only have a responsibility to execute the team goal; everything is decided by the organization (Hackman, 1987). Self-managed teams have no external leaders and decide for themselves how work should be accomplished (Manz & Sims, 1992). Self-designed teams have the responsibility of structuring the task, selecting (and removing) teammates, and create their own norms (Hackman, 1987). For self-designed team, the only responsibility out of their control is designing the organizational context. Self-governed teams are one step above self-designed teams. They have the same responsibilities, except they also control the organizational context. Figure 2 highlights the differences in Hackman's (1987) and Thompson's (2011) four team designs.

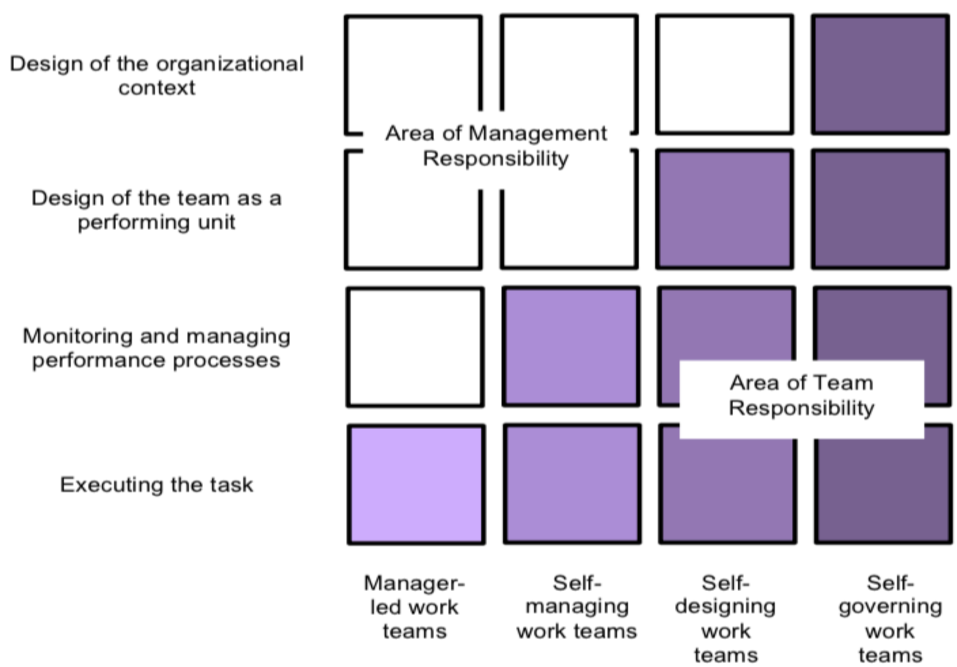

Figure 2. Authority of four types of work teams. Adapted from "Teams in Organizations," by L. L. Thompson, 2011, *Making the Team: A Guide for Managers,* p. 8.

Team staffing is the process of selecting individuals based on their knowledge, skills, abilities and other characteristics to form a team (Morgenson, Reider, & Campion, 2005). Employers assess individuals for fit in a teamwork environment. The goal of management is to utilize selection strategies to find the best fit between a person and the context of the team (Zaccaro & DiRosa, 2012). Selection for a team can either use traditional selection methods to choose individuals for a team, or a 'cluster hiring' method that recruits a whole unit to join an organization (Munyon, Summers, & Ferris, 2011). Team staffing focuses on a source outside of the team utilizing methods to try and assemble the best team for the organization.

Team composition is a well-researched area in team literature and examines the individual differences among teammates and the consequences of those differences on team processes, states, and outcomes (Barrick, Stewart, Neubert, & Mount, 1998; Bell, 2007; Bowers, Pharmers, Salas, 2000; Ilgen, Hollendbeck, Johnson, Jundt, 2005; Mathieu, J.E., Tannenbaum, S. I., Donsbach, J. S., & Alliger, G. M., 2014). The individual differences of interest can be surface level (gender, race; Bowers, Pharmers, Salas, 2000), deep level (personality, ability; Barrick, Stewart, Neubert, & Mount, 1998; Bell, 2007), or a characteristic of the individual or of the job (Ancona & Caldwell, 1992). Composition research highlights that the diversity within a team does indeed impact team functioning and effectiveness. Team assembly research is not concerned with team composition, per se. Team assembly research seeks to understand why certain individuals become teammates, which in turn affects the composition of the team. The assembly mechanisms used by individuals forming self-assembled teams determines team composition.

Proposed Assembly Mechanism Framework

An interdisciplinary approach is best to understand team assembly mechanisms. Much psychological research has been done to understand what draws individuals together (for various circumstances), as well as understanding how who is on a team affects team processes, states, and outcomes. What is missing from psychological research is combining what is currently known about teams and individual attraction into team assembly theories. Network science research has taken steps to identify models of team assembly mechanisms, as well as the influence these mechanisms have on team effectiveness. This approach also considers the dependency of mechanisms, a crucial way to understand and analyze how self-assembled team's form. The drawback from current network science is the incomplete theory explaining the motives behind teammate selection. Current team assembly research often draws from social psychology and network science, but there is a lack of cohesion across studies. The following proposed framework incorporates network science, social psychology, and current team assembly research.

From the previous literature review, there is a permeating theme to organize a team-based construct in two ways: task and social. Thus, it seems logical to organize assembly mechanisms into two types: taskwork and teamwork. Couple this assembly categorization with Contractor's (2013) model of team assembly and a truly interdisciplinary model of team assembly is born. Contractor's (2013) model has four levels: compositional, person-task fit, relational, and ecosystem. The first and third levels (compositional and relational) are the perfect levels to meld with the taskwork-teamwork organization, but the second and fourth levels are not appropriate to describe with a taskwork or teamwork dimension. The person-task fit level refers to an individual's *actual* fit with completing the task, not the perception a person has about someone's capability to complete a task. The ecosystem level solely measures who were previously teammates, and no other relationships. This level is more appropriate for an analysis that has teams forming and dissolving over time from the same pool of people, which is not the goal of this thesis. This thesis aims to test the idea of taskwork and teamwork dimensions of the compositional and relational levels. For the compositional level, taskwork assembly mechanisms are defined as choosing teammates based on an individual's ability to accomplish the team goal. Teamwork assembly mechanisms are defined as choosing teammates for reasons beyond a person's ability to achieve the team goal. For the relational level, taskwork assembly mechanisms are defined as choosing teammates based on a previous work or advice relationship. Teamwork assembly mechanisms are defined as choosing teammates based on previous social relationships. Table 1 depicts the team assembly model proposed by this thesis.

Table 1
Team Assembly Framework

Level	Dimension	Definition	Exemplar Factors Used as the Basis for Team Assembly
Compositional	Taskwork	Choosing teammates based on an individual's ability to accomplish the team goal	Individual KSA related to accomplishing team goal such as task knowledge, functional background, work experience, or programming skills.
	Teamwork	Choosing teammates based on an individual's ability to positively contribute to group maintenance	Characteristics of individuals that suggest the individual may contribute to group maintenance such as psychological collectivism, intercultural sensitivity, openness to experience, agreeableness, or similarity to the person making the teammate decision.
Relational	Taskwork	Choosing teammates based on previous work or advice relationships	Advice ties, instrumental ties, knowledge network ties, information sharing ties
	Teamwork	Choosing teammates based on previous relationships	Friendship ties, affective ties, trust ties

Team Conflict and Team Assembly

Team conflict is a team process that originates in perceived differences among group members (de Witt, Greer & Jehn, 2011). Conflict within the team has far reaching impact on numerous team-level constructs, such as cohesion (Acuna, Gomez, & Juristo, 2008; Jehn & Mannix, 2001), satisfaction (Acuna et al., 2008, DeChurch & Marks, 2001), trust (Curseu & Schruijer, 2010; Jehn & Mannix, 2001) and performance (Curseu & Schruijer, 2010; Jehn & Mannix, 2001). Conflict's enduring presence in a variety of situations and conflict's many effects on teams give importance to thoroughly understanding what affects conflict within the team. We know much about conflict within teams, but not how team assembly choices affects the resulting conflict that arises within the team after it is formed. A team's experience of conflict may well depend in part on the assembly mechanism by which the team was formed. Prior research on team conflict distinguishes conflict processes from conflict states (DeChurch, Mesmer-Magnus, & Doty, 2013). Conflict states are dynamic and can vary depending on the context, inputs, processes and outcomes of a team, whereas conflict processes are team members acts that transform inputs into outputs (Marks, Mathieu, & Zaccaro, 2001). The current study focuses on how team assembly shapes the formation of individuals' conflict states, or perceptions of disagreement within the team. Research on conflict states in teams distinguishes two types of disagreements in teams: task conflict includes disagreements over ideas related to the project, and relationship conflict includes disagreement resulting from interpersonal issues (Jehn, 1995).

De Wit, Greer, and Jehn's (2011) meta-analysis of intragroup conflict provided clear evidence that team members' perceptions of task conflict and relationship conflict are negatively related to group affective outcomes including satisfaction, trust, commitment, and organizational citizenship behavior. However, Bradley, Klotz, Postlehwaite, and Brown (2012) found individual personality traits could moderate these relationships. In particular, when teams are composed of members high in the traits of openness to experience and emotional stability, task conflict is positively related to team performance. These findings demonstrate that the effects of team conflict on team outcomes are complex; specifically that the consequences of conflict depend in part on the individual's traits in the team.

Considering the complexity of team conflict, it is beneficial for researchers to understand how their teammate selection mechanisms affect team conflict. People may create specific perceptions of expected behaviors of their teammates based on whether they were chosen for a social or task reason. First impressions are made by information available to an individual, and it is this information that people use to make assembly choices. Asch (1946) found differences in impressions formed when participants were given information with slight differences of a fictional individual. Depending on the information individuals pay attention to (thereby affecting assembly mechanism), people can construct different perceptions about possible teammates. The perceptions teammates create of each other lead to differentiating impacts of team assembly mechanisms on the relationship and task conflict. Opinions of teammates can change over time, thus it is tenable that team assembly mechanisms may impact conflict differently as the team works together.

Where teams are in their team lifespan or product development phase influences the conflict experienced by the team. Tuckman (1965) described group development in five stages: forming, storming, norming, performing, and adjourning. In this model, conflict occurs at the start of the group functions, at the 'storming' stage. Conflict can occur throughout the life of the group, but Tuckman identified a period of time shortly after forming where conflict occurs to settle procedural, interpersonal, and task disagreements. Thus at this 'storming' stage, team assembly mechanisms can differentially impact the types of conflict experienced during the early stages of group work.

New product development (NPD) teams go through a series of steps to create a product. During the team's lifetime task-related priorities evolve. For creative teams such as NPD teams, the beginning of the team's lifecycle focuses on idea generation and task management and later phases focus on goal execution (Gersick 1988). Coming up with a creative idea is not a linear process. Often teams test and evaluate ideas before moving forward with one idea. Assessing ideas and coming up with alternative solutions may be necessary if initial ideas do not work (Paulus, 2002). The majority of teams have external time constraints or pressures, so at some point the team will need to agree on one idea and move forward. Thus teams go through an early ideation phase, implementation phase (assessing ideas and executing them), and a final evaluation phase.

Although it is functional for teams to experience task conflict during the ideation phase (Farh, Lee, Farh, 2010), teams who choose members for social reasons may not engage in task conflict in an effort to preserve cohesion and interpersonal relationships. Therefore, individuals who choose others for social-based reasons are unlikely to report task conflict with that person at the beginning of a project. During the implementation and evaluation phase, it is expected that individuals will not engage in task conflict frequently, no matter the assembly mechanism individual's use. At this time teams should be focused on working together to complete the task, not engage in debate on how to complete the task. Thus:

Hypothesis 1a: During the ideation phase, a person is significantly less likely to experience task conflict with a teammate chosen using a compositional teamwork assembly mechanism rather than not using this mechanism.

Hypothesis 1b: During the ideation phase, a person is significantly less likely to experience task conflict with a teammate chosen using a relational teamwork assembly mechanism rather than not using this mechanism.

Throughout the project, it is expected that teammates chosen with a teamwork mechanism at the compositional or relational level are unlikely to experience relationship conflict. The motives for choosing these individuals are not based in the belief of their ability to complete team goals. Rather, these teammates are chosen based on the characteristics of the person, which may signal that this possible teammate would be easy to get along with. This should ease tensions throughout each phase of the project (ideation, implementation, evaluation). Thus:

Hypothesis 2a: During all phases of the project, a person is significantly less likely to experience relationship conflict with a teammate chosen using a compositional teamwork mechanism rather than not using this mechanism.

Hypothesis 2b: During all phases of the project, a person is significantly less likely to experience relationship conflict with a teammate chosen using a relational teamwork mechanism rather than not using this mechanism.

There are different benefits and shortcomings for using different assembly mechanisms. Those who form purely on compositional level taskwork mechanisms will be strangers, and will have to develop the interpersonal relations useful for team performance (e.g. cohesion; Beal, Cohen, Burke & McLendon, 2003). Getting to know teammates while completing tasks could lead to tension and conflict within a team as they are develop their relationship. Individuals who choose teammates using a relational mechanism will not suffer from this hardship. Higher levels of trust and cohesion can exist between teammates who have a previous relationship, and thus relationship conflict is less likely to occur with those individuals (De Wit et al., 2011). This thesis posits that an individual who chooses a teammate with a compositional level taskwork mechanism will develop a relationship conflict tie with that teammate during the ideation phase of the project. It is not expected that the teammates chosen using a relational level taskwork mechanism will experience high amounts of conflict because of their previous experience with each other. For both the compositional level and relational level taskwork mechanisms, it is expected that individuals will experience task conflict throughout the project. These teammates were chosen because of their expertise, thus there is a certain expectation of these individuals to bring different and unique ideas to the group, which may cause task conflict. Thus:

Hypothesis 3: During the ideation phase, a person is significantly more likely to experience relationship conflict with a teammate chosen using a compositional taskwork assembly mechanism rather than not using this mechanism.

Hypothesis 4a: During all phases of the project, a person is significantly more likely to experience task conflict with a teammate chosen using a compositional taskwork assembly mechanism rather than not using this mechanism.

Hypothesis 4b: During all phases of the project, a person is significantly more likely to experience task conflict with a teammate chosen using a relational taskwork assembly mechanism rather than not using this mechanism.

Team Viability and Team Assembly

What are of major interest to organizations and researchers alike are not only team functioning, but also team outcomes, such as performance and viability. Viability is the willingness of team members to continue working together and how much they liked being on the team (Barrick et al., 1998). A team is considered effective when they are able to produce results as well as being able to work together to complete future tasks (team viability). Employers want effective teams in their employ, as this would bring the best results to the organization. Within organizations teams are likely to have a longer lifetime than their current team goal (Balkundi & Harrison, 2006). Team viability is important to the production of new scientific knowledge. Guimera and his colleagues (2005) found it best to have a mix of new *and* previous teammates to produce successful, high impact science. Teams will not only need to be effective currently, but also effective in the future. Differences in team assembly mechanisms may not only affect the experience of team conflict, but may also explain team viability.

Viability of the team is an interesting metric to understand how well people chose their teammates. These individuals self-assembled into teams, and viability assesses if they are willing to be on a team with these individuals again. People who are willing to be on a team with the same people again assembled ‘correctly’, and those who are not willing may have assembled ‘incorrectly’ at the beginning. Viability may benefit from relational-level mechanisms, since these individuals previously had a relationship prior to being on a team and those individuals chose to continue their relationship as teammates. Teams can be separated into two categories, high and low viability, and the dyadic relationships can then be analyzed to know what team assembly mechanisms are likely to occur. Therefore, *Hypothesis 5a: In teams with high viability, dyads are significantly more likely to use a relational teamwork mechanism to choose teammates than not using this mechanism.*

Hypothesis 5b: In teams with high viability, dyads are significantly more likely to use a relational taskwork mechanism to choose teammates than not using this mechanism.

Hypothesis 6a: In teams with low viability, dyads are significantly less likely to use a relational teamwork mechanism to choose teammates than not using this mechanism.

Hypothesis 6b: In teams with low viability, dyads are significantly less likely to use a relational taskwork mechanism to choose teammates than not using this mechanism.

All of the proposed hypotheses can be viewed in Figure 3.

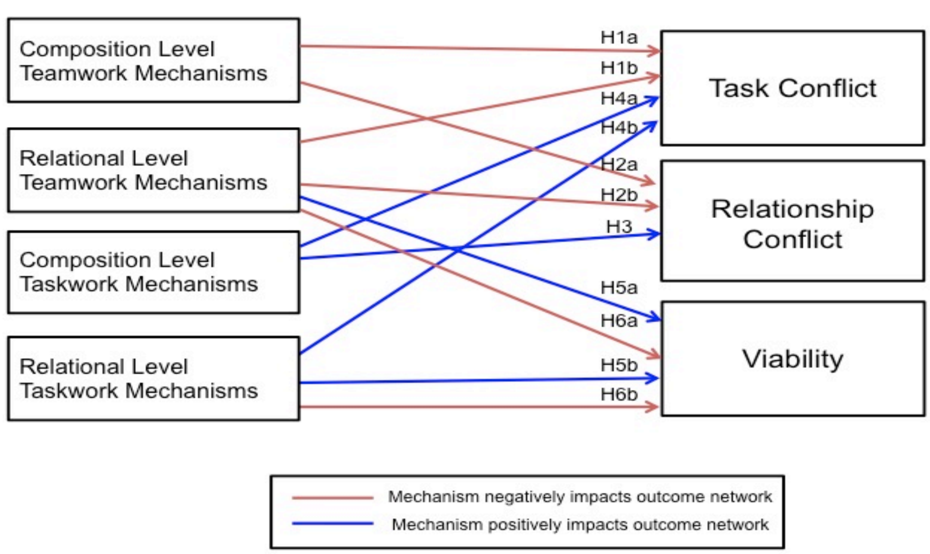

Figure 3. Conceptual model of current hypotheses.

CHAPTER 2

METHOD

Participants were students enrolled in a graduate level human-computer interaction course completing a semester-long team design project. Teams from three semesters of this course were studied. In the first semester, 45 individuals self-organized into 13 teams. In the second semester, 48 individuals self-organized into 12 teams. In the third semester, 48 individuals self-organized into 14 teams. Across the semesters, 55% were male, 34% were Caucasian, 25 % were Indian, 24% were Chinese, and 17% were of other ethnicity. Historically, students in this class have a diverse background in terms of previous degrees earned. The majors included 28% computer science, 14% engineering, 14% social science, 14% double major in engineering and computer science, or 30% other.

Team Task

For three months, students worked on a team project developing a prototype to better the lives of others by utilizing technology. This was a class project with four main deliverables, each with about three weeks to complete. The team was tasked with developing an alternative interface for a computer-based application. The project required students to evaluate users and their needs, design a new interface, develop a prototype of that interface, and evaluate the design.

Procedure

At the beginning of the course students self assembled into teams of three to four members using a class wiki. First, each student created a profile in the wiki that consisted of four parts: background, schedule, other, and project ideas. For background, students summarized their previously earned degree, previous relevant work experience, relevant skills and knowledge they have, and previous teamwork experience. For schedule, students described their general availability to meet and work. In the other field, students wrote about themselves: their interests, their hometown (or country), and other languages they speak. In project ideas, students described their initial ideas for the project.

The team formation phase lasted nine days. During this time students uploaded their profile to the wiki, reviewed one another's wiki profiles, contacted prospective teammates, and then informed their instructor of who is on their team. To select teammates, students indicated on the wiki who they wish to work with, emailed each other, or spoke to each other at class. If by the time the team formation is over and someone had not chosen a team, the course instructor assigned them to a team. For each semester of data collection, no individuals were assigned to a team.

The class project was broken into four parts: brainstorming the problem, developing alternative solutions, creating a prototype, and evaluation. Participants were surveyed at four points in time, the first immediately after all the teams were assembled to assess team assembly mechanisms. The following three surveys were administered after each part of the project was due. Conflict was measured at all three time points, and viability was measured at the last time point.

Measures

Team assembly mechanisms were assessed sociometrically using Contractor's (2012) multi-theoretical multilevel model for team assembly, with each question framed as "Which of the following factors were important to you in deciding whether to be on a team with this person." This scale measured individual's perceptions for choosing another as a teammate and assessed the compositional and relational levels. All of the items are listed in Table 2.

Table 2

List of self-report compositional teamwork and taskwork assembly mechanisms

Mechanism	Items
Compositional teamwork	This is a fun person
Compositional teamwork	Is outgoing
Compositional teamwork	I trust him/her
Compositional teamwork	Is the same/different gender as me
Compositional teamwork	Is the same/different age as me
Compositional teamwork	Is the same/different hometown or country as me
Compositional teamwork	Is the same/different race as me
Compositional taskwork	Has skills I do not have
Compositional taskwork	I have skills to offer this person and this person has skills to offer me
Compositional taskwork	Is a good student
Compositional taskwork	Has the same/different knowledge and skills as me
Compositional taskwork	Is the same/different major as me
Compositional taskwork	Is always communicating with everyone
Compositional taskwork	Has information or resources I need
Compositional taskwork	Together we will do a better job than either of us could do individually
Compositional taskwork	This person and me have complementary skills

The average reliability for the compositional taskwork and compositional teamwork across the semesters of data collection is adequate (α= .72 and α= .58, respectively). Binary networks were made for taskwork and teamwork mechanisms from the questionnaire. To do this, each person's use of a specific decision (each item) was tallied and the number of decisions used (items responded as important factors) was averaged across the sample. Those who fell above the average were considered as using that mechanism, and those that fell below the average will be considered as not using the mechanism. See Figure 4 and 5 for a distribution of responses.

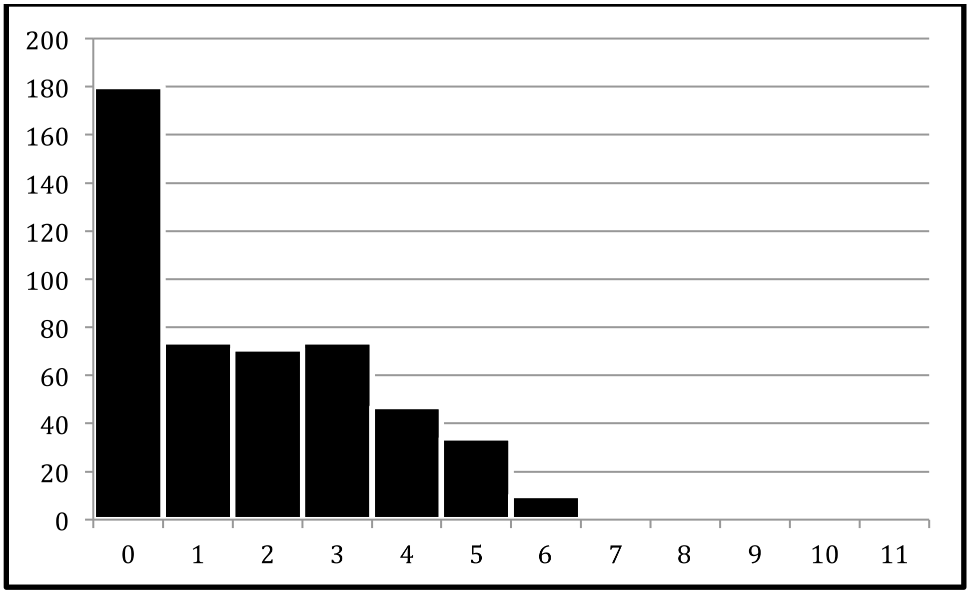

Figure 4. Frequency chart showing the number of individuals who utilized compositional teamwork mechanisms a specific number of times. To dichomotize the data, individuals who used two or fewer mechanisms were coded as 0 (not having used the mechanism) and individuals who used three or more mechanisms were coded as 1 (having used the mechanism).

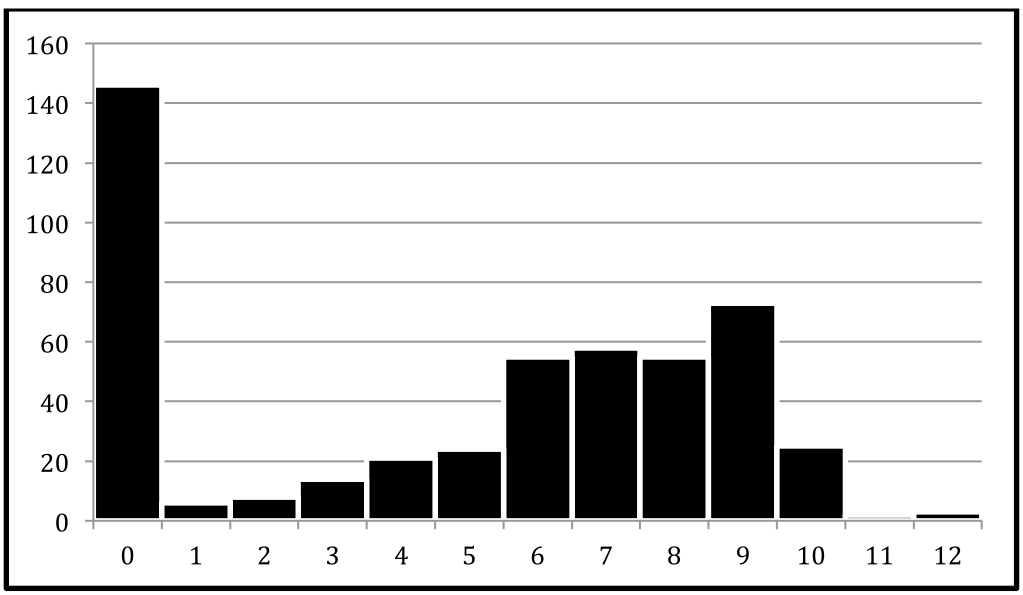

Figure 5. Frequency chart showing the number of individuals who utilized compositional taskwork mechanisms a specific number of times. To dichomotize the data, individuals who used six or fewer mechanisms were coded as 0 (not having used the mechanism) and individuals who used seven or more mechanisms were coded as 1 (having used the mechanism).

In addition to the self-report assembly questions, participants were asked about their friend and advice networks within the class. The advice network item states, "Who on the list do you consider an important source of information and advice for school/study-related matters?" The friendship network item states, "Who on the list do you consider an important source of friendship and social enjoyment?" These two networks are the relational assembly mechanisms for the teamwork (i.e., friendship) mechanism and the taskwork (i.e., advice) mechanism.

Conflict was measured sociometrically using an adapted scale from Befar, Mannix, Peterson, and Trochim (2011). To assess task conflict, the item states, "This person and I disagreed about ideas related to the team project," with each member of the team as the referent. To assess relationship conflict, the item states "I experience emotional tension when working with this person," with each member of the team as the referent. Each participant responded yes or no to that statement. Responses were binary, with 1 meaning yes and 0 meaning no. Conflict was measured at three different times throughout the project.

Team viability was assessed following Resick et al.'s (2010) example of using a 5-item scale that combines items from a team satisfaction scale (Tesluk & Mathieu, 1999) and a willingness to work with teammates scale (Bayazit & Mannix, 2003). Participants responded on a 5-point likert scale (1=Strongly Disagree to 5=Strongly Agree). The average reliability for the viability scales was adequate across the semesters (α= .81). The integrity of the responses were questionable for ten respondents because they did not answer the reverse coded item in manner that matched their other responses. As recommended in the literature, these ten individuals were removed from analyses using team viability (Huang, Curran, Keeney, Poposki, & DeShon, 2012).

CHAPTER 3

ANALYTICAL METHOD

Each conflict hypothesis (H1-H4) proposed that a conflict tie would form between two teammates based on the assembly mechanism, or reason why these individuals chose to work together. These hypotheses were tested using exponential random graph modeling a technique ideally suited to analyzing relational, social network data that by its very nature, violates assumptions of independence (ERGM; Contractor et al., 2012; Robins, Pattison, Kalish, & Lusher, 2007). ERGM compares an observed network of conflict ties to a distribution of randomly generated networks with the same number of nodes to statistically test if features of the observed network were likely to have occurred by chance. ERGM first counts how frequently the observed conflict tie occurs between any two nodes (teammates). This frequency is entered into a matrix that has the observed conflict ties between each team member for all teams. Then you generate a distribution of networks so that you can assess if the frequency distribution we observed is due to chance. This distribution includes the same number of nodes and ties as the observed network. Next, you compare the frequency of the hypothesized structure in the observed network with the frequencies of that structure in the generated network. The formula used to create the distribution of networks is:

$$P(X = x) = k^{-1}\exp\left(\sum_{A \subseteq N_D} \lambda_A Z_A(x)\right)$$

(Contractor et al. 2012)

To test my hypotheses, I created four different independent variable networks: a composition level taskwork assembly network, a composition level teamwork assembly network, a relational level taskwork assembly network, and a relational level teamwork assembly network. Each network is depicted in Figure 6 & 7.

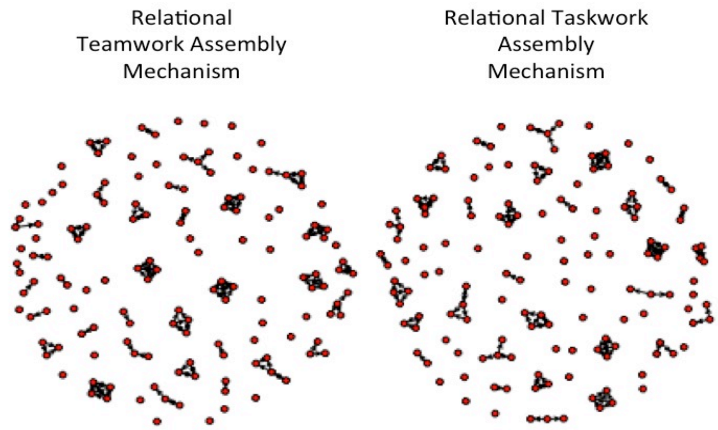

Figure 6. Social networks depicting relational teamwork and relational taskwork assembly mechanisms. Note that team placement in each figure is random, and what information provided by the figures is the amount of relationships that exist for each assembly mechanism.

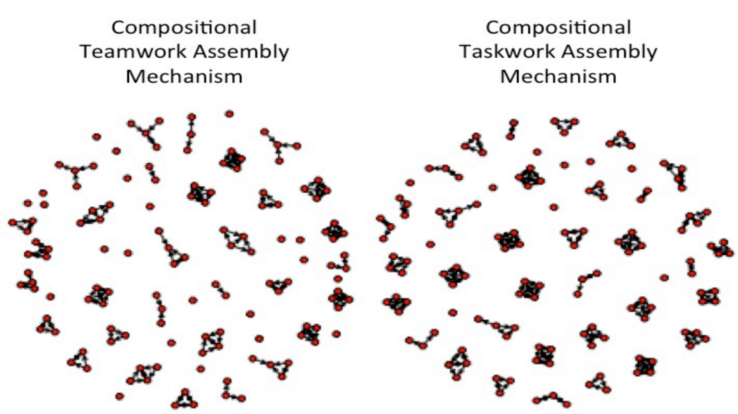

Figure 7. Social networks depicting compositional teamwork and relational taskwork assembly mechanisms. Note that team placement in each figure is random, and what information provided by the figures is the amount of relationships that exist for each assembly mechanism.

My dependent variables are task and relationship conflict, so I created a network for each conflict type and each time point, for a total of six networks (i.e., 4 networks as independent variables and 2 networks as dependent variables). Using ERGM's, I predicted the ability of a particular network (assembly mechanism) to predict another network (conflict). In this study, I am predicting the likelihood of my four assembly networks predicting the six conflict networks. A significant positive effect estimate indicates that given a tie in the independent network, a tie is likely to form in the dependent network. A significant negative relationship indicates that given a tie in the independent network, a tie is unlikely to form in the dependent network. Null results simply indicate that the independent network does not predict if a tie will or will not form in the dependent network.

Hypotheses 5 and 6 propose a relationship between assembly mechanisms and viability, a team-level, non-network, outcome variable. Initially these hypotheses were to be analyzed using ERGMs by splitting the sample into high and low viable teams utilizing a median-split and then conducting ERGMs within each group. The data did not support doing a median split due to the positively skewed distribution of the viability responses. Figure 8 shows the distribution of responses to the team viability scale across all semesters.

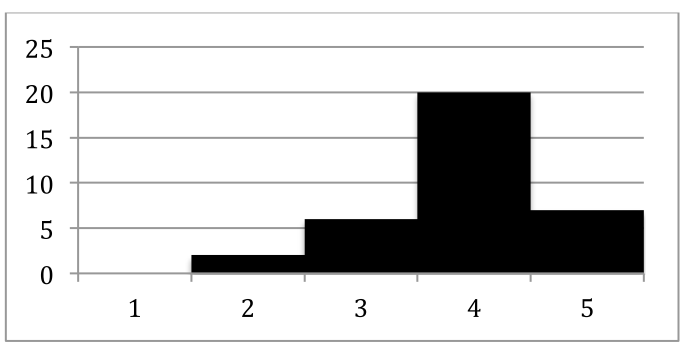

Figure 8. Distritubtion of team viability responses. Most teams report an average viability of four (where one is the lowest and five is the highest).

The mean of team viability is 3.88 with a standard deviation of 0.70, showing there is a range restriction in the team viability responses Thus, instead of using ERGMs to analyze team assembly mechanisms effect on team viability, I used linear regression. To do so, I need to create a team-level metric for the relational taskwork and teamwork assembly mechanism network. I calculated the out-degree centrality of each participant's friendship and advice networks, and this metric can be understood as how often individual's report friends or advice relations within their team. To control for the varying team sizes, I divided the centrality metric by the number of people on the team. Team viability is a team-level construct, thus I averaged the team members centrality metric to create a team-level aggregate. To analyze Hypothesis 5 & 6 I conducted a linear regression with the centrality metric (how often individuals are reported as friends/advice givers) predicting team viability.

CHAPTER 4

RESULTS

Each hypothesis result is detailed below. For each ERGM analysis I controlled for reciprocity, a self-organizing tendency of most social networks, and the semester the data collection took place by entering a node attribute into each ERGM equation, which essentially tells the equation which nodes belong to which semester. By controlling for reciprocity I am accounting for a unique variance found in social network analytical methods where ties are likely to be reciprocated in any given network, and this is a precedent set in other ERGM studies (e.g. Valente, Fujimoto, Chou, & Spruijt-Metz, 2009). Each analysis for Hypothesis 1-4 used the ERGM signature edge covariate. The edge covariate signature counts how many times a person used an assembly mechanism and reported conflict with that person in my observed data and in the simulated network distribution and then compares the two counts to statistically test if my network is occurring beyond chance.

Team Assembly's Impact on Team Conflict

Hypothesis 1a posits that compositional teamwork assembly mechanisms predict task conflict at the first time point. Using ERGMS, I tested if the compositional teamwork assembly network predicted my task conflict network. More precisely, I used the edge covariate signature to test if the ties between nodes in the compositional teamwork assembly network predicted the formation of task conflict ties between those same nodes at time one. This was not supported, as the ERGM effect estimate was -0.34 (*p*= .2, ns). This means that compositional teamwork assembly mechanisms have no impact on the formation of task conflict ties at time one. The results do not show that these compositional teamwork mechanisms affect the likelihood *or unlikelihood* of task conflict tie formation.

Similarly, Hypothesis 1b posits that relational teamwork assembly mechanisms predict task conflict at the first time point. I used the edge covariate signature in ERGM to test if the ties between nodes in the relational teamwork assembly network predicted the formation of ties between the same nodes in the task conflict network at time one. This was also not supported, as the ERGM effect estimate was-0.09 (p= .7, ns). This means that relational teamwork assembly mechanisms have no impact on the formation of task conflict ties at time one. The results do *not* show that these relational teamwork mechanisms affect the likelihood *or unlikelihood* of task conflict tie formation. The results for Hypothesis 1 can be found in Table 3.

Table 3

ERGM results of Teamwork Assembly Mechanisms predicting Task Conflict at Time 1

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 1a (t= 37, n=119, l=73)			
Self-Organizing Principles			
Edge	-1.32**	0.41	0.27
Reciprocity	0.45	0.42	1.57
Control			
Year	0.07	0.09	1.07
Main Effect (l=142)			
Compositional Teamwork Assembly	-0.34	0.28	0.71
Hypothesis 1b (t=38, n=128, l=84)			
Self-Organizing Principles			
Edge	-2.22***	0.39	0.11
Reciprocity	1.28**	0.48	3.60
Control			
Year	0.008	0.007	1.008
Main Effect (l=107)			
Relational Teamwork Assembly	-0.09	0.32	0.91

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes p<.05,** denotes p<.01, ***denotes p<.001.

Hypothesis 2a states that compositional teamwork assembly mechanism networks predict relationship conflict at time one, two, and three. I used the edge covariate signature in ERGM to test if the ties between nodes in the compositional teamwork assembly network predicted the formation of relationship conflict ties between those same nodes at time one, two or three (each time point is a separate network). Hypothesis 2a was not supported, as the ERGM effect estimate at the first time point was -0.14 (p= .7, ns), for the second time point the effect estimate was -0.31 (p= .4, ns), and the third time point the effect estimate was 0.42 (p= .2, ns). What can be concluded is that compositional teamwork assembly mechanisms do not impact relationship conflict at any time point. The results do *not* indicate that these compositional teamwork mechanisms affect the likelihood *or unlikelihood* of relationship conflict tie formation. The results for Hypothesis 2a can be found in Table 4.

Table 4

ERGM results of Teamwork Assembly Mechanisms predicting Relationship Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 2a Time 1 (t=36, n=117, l=92)			
Self-Organizing Principles			
Edge	-2.65***	0.61	0.07
Reciprocity	0.97	0.62	2.64
Control			
Year	0.14	0.13	1.15
Main Effect (l=141)			
Compositional Teamwork Assembly	-0.14	0.35	0.87
Hypothesis 2a Time 2 (t=37, n=120, l=43)			
Self-Organizing Principles			
Edge	-4.38***	0.62	0.01
Reciprocity	1.13*	0.54	3.10
Control			
Year	0.58***	0.13	1.79
Main Effect (l=146)			
Compositional Teamwork Assembly	-0.31	0.34	0.73
Hypothesis 2a Time 3 (t=37, n=116, l=42)			
Self-Organizing Principles			
Edge	-3.01***	0.47	0.05
Reciprocity	1.78***	0.52	5.93
Control			
Year	0.19	0.10	1.21
Main Effect (l=130)			
Compositional Teamwork Assembly	0.42	0.34	1.52

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes p<.05, ** denotes p<.01, ***denotes p<.001.

Hypothesis 2b states that relational teamwork assembly mechanisms predict relationship conflict at time one, two, and three. Using the edge covariate signature in ERGM, I tested if the ties between nodes in the relational teamwork assembly network predicted the formation of relationship conflict ties between those same nodes at time one, two or three (each time point is a separate network). Relational teamwork assembly mechanism networks did not predict relationship conflict at the first time point with an effect estimate of 0.33 (p= .4, ns), the second time point with an effect estimate of 0.15

(*p*= .7, ns), or the third time point with an effect estimate of 0.45 (*p*= .1, ns). Thus there was no support for Hypothesis 2b meaning that relational teamwork assembly mechanism networks do not impact relationship conflict networks. The results do *not* indicate that these relational teamwork mechanisms affect the likelihood *or unlikelihood* of relationship conflict tie formation. The results for Hypothesis 2b can be found in Table 5.

Table 5

ERGM results of Teamwork Assembly Mechanisms predicting Relationship Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 2b Time 1 (t=39, n=130, l=53)			
Self-Organizing Principles			
Edge	-2.51***	0.57	0.08
Reciprocity	0.61	0.66	1.84
Control			
Year	0.06	0.11	1.06
Main Effect(l=108)			
Relational Teamwork Assembly	0.33	0.36	1.39
Hypothesis 2b Time 2 (t=38, n=130, l=52)			
Self-Organizing Principles			
Edge	-3.78***	0.49	0.02
Reciprocity	1.46	0.52	4.31
Control			
Year	0.37***	0.10	1.45
Main Effect(l=117)			
Relational Teamwork Assembly	0.15	0.33	1.16
Hypothesis 2b Time 3 (t=37, n=123, l=53)			
Self-Organizing Principles			
Edge	-2.84***	0.34	0.06
Reciprocity	2.08***	0.46	8.00
Control			
Year	0.15	0.08	1.16
Main Effect(l=110)			
Relational Teamwork Assembly	0.45	0.29	1.57

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes $p<.05$, ***denotes $p<.001$.

Hypothesis 3 posits that compositional taskwork assembly mechanism predict relationship conflict at time one. To test H3 I used the edge covariate signature in ERGM which tests if the ties between nodes in the compositional taskwork assembly mechanism network predict the formation of relationship conflict ties between those same nodes at time one. Compositional taskwork assembly mechanism networks did not predict relationship conflict at the first time point with an effect estimate of 0.05 (p= .9, ns). Thus there was no support for Hypothesis 3 meaning that compositional taskwork assembly mechanisms have no effect on the formation of relationship conflict at time one. The results do *not* show that these compositional taskwork mechanisms affect the likelihood *or unlikelihood* of relationship conflict tie formation. The result for Hypothesis 3 can be found in Table 6.

Table 6

ERGM results of Taskwork Assembly Mechanisms predicting Relationship Conflict at Time 1

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 3 (t=37, n=119, l=30)			
Self-Organizing Principles			
Edge	-2.70***	0.58	0.07
Reciprocity	0.94	0.55	2.56
Control			
Year	0.17	0.11	1.19
Main Effect(l=182)			
Compositional Taskwork Assembly	0.05	0.34	1.05

Note. t=number of teams, n=number of individuals, l=number of dyadic connections. *denotes p<.05, ***denotes p<.001.

Hypothesis 4a proposed compositional taskwork assembly mechanisms predicting task conflict at each phase of the project. Using the edge covariate signature in ERGMS, I tested if the ties between nodes in the compositional taskwork assembly mechanism network predict the formation of task conflict ties between those same nodes at time one, two or three (each time point is a separate network). At time two, compositional taskwork assembly mechanisms did predict the formation of task conflict ties with an effect estimate of 0.68 ($p<.05$). ERGM produces a log-odds for each predictor and the odds ratio is an interpretable parameter that tells us the likelihood of a tie forming given our predictor variable. For time two, the odds ratio is 1.98, meaning that individuals who used a compositional taskwork assembly mechanism were almost twice as likely to experience task conflict with that individual. This result remained significant when the other assembly mechanisms were entered into the model as edge covariates. With the other mechanisms in the model, the effect estimate for compositional taskwork is 0.88 ($p<.05$), and the odds ratio is 2.41. By adding the other mechanisms into the model, the significant finding with compositional taskwork assembly mechanisms is more robust.

Time one and time three for Hypothesis 4a did not yield significant results, with an effect estimate of 0.08 and 0.12, respectively ($p>.05$, ns). This result means that at time one and three, compositional taskwork assembly mechanisms have no effect on the formation of task conflict. These results do *not* show that these compositional taskwork mechanisms affect the likelihood *or unlikelihood* of task conflict tie formation at time one or three. The result for Hypothesis 4a can be found in Table 7.

Table 7

ERGM results of Taskwork Assembly Mechanisms predicting Task Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 4a Time 1 (t=37, n=119, l=72)			
Self-Organizing Principles			
Edge	-1.55***	0.46	0.21
Reciprocity	0.52	0.42	1.68
Control			
Year	0.06	0.09	1.06
Main Effect(l=182)			
Compositional Taskwork Assembly	0.08	0.29	1.08
Hypothesis 4a Time 2 (t=37, n=120, l=78)			
Self-Organizing Principles			
Edge	-3.76***	0.58	0.02
Reciprocity	1.49**	0.48	4.44
Control			
Year	0.34***	0.10	1.40
Main Effect(l=186)			
Compositional Taskwork Assembly	0.68*	0.33	1.97
Hypothesis 4a Time 2 (t=37, n=120, l=78)			
Self-Organizing Principles			
Edge	-3.98***	0.63	0.02
Reciprocity	1.51**	0.49	4.52
Control			
Year	0.41**	0.12	0.41
Main Effect(l=186)			
Compositional Taskwork Assembly	0.88*	0.38	2.41
Compositional Teamwork Assembly	-0.46	0.37	0.63
Relational Taskwork Assembly	0.18	0.44	1.20
Relational Teamwork Assembly	-0.46	0.43	0.67
Hypothesis 4a Time 3 (t=37, n=116, l=59)			
Self-Organizing Principles			
Edge	-3.20***	0.48	0.04
Reciprocity	1.18**	0.51	3.25
Control			
Year	0.32**	0.10	1.38
Main Effect(l=169)			
Compositional Taskwork Assembly	0.12	0.34	1.13

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes p<.05, ** denotes p<.01, ***denotes p<.001.

Hypothesis 4b proposed relational task assembly mechanisms predicting task conflict at each phase of the project. Using the edge covariate signature in ERGMS, I tested if the ties between nodes in the relational taskwork assembly mechanism network predict the formation of task conflict ties between those same nodes at time one, two or three (each time point is a separate network). At time three, relational task assembly mechanisms did predict the formation of task conflict ties with an effect estimate of 0.65 ($p<.05$). For time three, the odds ratio is 1.92, meaning that individuals who used a relational task assembly mechanism were almost twice as likely to experience task conflict with that individual. This result did not remain significant when the other assembly mechanisms were entered into the model as edge covariates. By adding the other mechanisms into the model, the significant finding with relational taskwork mechanisms is not as meaningful.

Time one and time two for Hypothesis 4b did not yield significant results with an effect estimate of -0.26 and 0.03, respectively ($p>.05$, ns). This result means that at time one and two, relational taskwork assembly mechanisms have no effect on the formation of task conflict. These results do *not* show that these relational taskwork mechanisms affect the likelihood *or unlikelihood* of task conflict tie formation at time one or two. The result for Hypothesis 4b can be found in Table 8.

Table 8

ERGM results of Taskwork Assembly Mechanisms predicting Task Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 4b Time 1 (t=39, n=130, l=84)			
Self-Organizing Principles			
Edge	-1.46***	0.42	0.23
Reciprocity	0.47	0.39	1.60
Control			
Year	0.08	0.08	1.08
Main Effect(l=109)			
Relational Taskwork Assembly	-0.26	0.27	0.77
Hypothesis 4b Time 2 (t=38, n=130, l=91)			
Self-Organizing Principles			
Edge	-3.34***	0.48	0.04
Reciprocity	1.47**	0.47	4.35
Control			
Year	0.33***	0.09	1.39
Main Effect(l=111)			
Relational Taskwork Assembly	0.03	0.32	1.03
Hypothesis 4b Time 3 (t=37, n=123, l=74)			
Self-Organizing Principles			
Edge	-2.32***	0.39	0.10
Reciprocity	0.85*	0.41	2.34
Control			
Year	0.18*	0.08	1.20
Main Effect(l=106)			
Relational Taskwork Assembly	0.65*	0.28	1.92
Hypothesis 4b Time 3 (t=37, n=123, l=74)			
Self-Organizing Principles			
Edge	-3.14***	0.57	0.04
Reciprocity	1.19*	0.54	3.30
Control			
Year	0.27*	0.12	1.30
Main Effect (l=186)			
Compositional Taskwork Assembly	0.21	0.35	1.24
Compositional Teamwork Assembly	-0.65	0.37	0.52
Relational Taskwork Assembly	0.63	0.44	1.89
Relational Teamwork Assembly	0.22	0.41	1.24

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes p<.05, ** denotes p<.01, ***denotes p<.001.

Team Assembly's Impact on Team Viability

Hypothesis 5 and 6 proposed that relational team assembly mechanisms (task or teamwork) would predict the viability of the team. Relational taskwork and teamwork mechanisms did no predict team viability, $R^2 = .04$, $F(3,31)=.48$, $p=.69$. Thus, Hypothesis 5 and 6 were not supported as shown in Table 9.

Table 9

Regression Results for Team Viability (N=35)

Variable	Team Viability					
	Model 1		Model 2		Model 3	
	β	SE	β	SE	β	SE
Year	-0.03	0.11	-0.02	0.11	-0.02	0.11
Relational Taskwork Mechanism			0.04	0.26	0.01	0.39
Relational Teamwork Mechanism					0.03	0.39
R^2	0.0		0.002		0.002	
ΔR^2			0.002		0.0	

Note. Coefficients are standardized β.

Given that many of the hypotheses were not supported, I ran two sets of supplemental analyses to explore potential "methodological" reasons for the null findings. The first set addresses the relatively low base rate phenomenon of team conflict, by using a composite network that collapses conflict networks over time. The second set of analyses addresses the fact that team assembly was assessed via self-report. I supplement these analyses by retesting the hypotheses instead using data on individual's characteristics and inferring the reasons for team assembly based on my framework.

Supplemental Analysis 1

A closer inspection of the data revealed that at each time point there were few conflict ties present. The lack of ties suggest there may have not been enough conflict data at each time point to properly capture potential relationships between assembly mechanisms and the development of conflict. To address this, I collapsed each time point into one composite network of task or relationship conflict for a team. Figure 9 and 10 show a visual representation of the task and relationship conflict networks at each time point as well as the composite network.

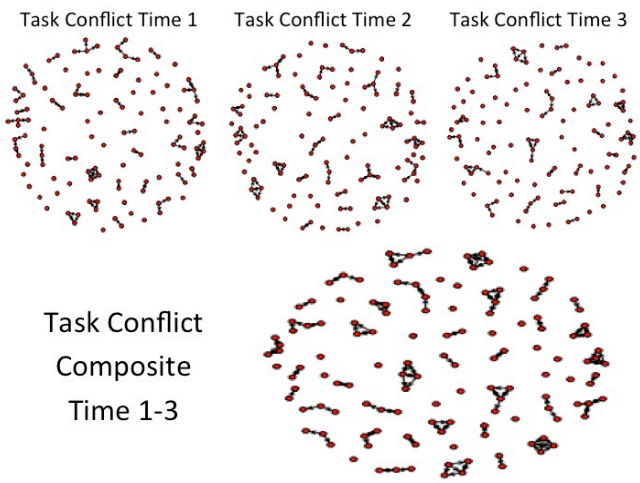

Figure 9. Social networks of task conflict at time 1, time 2, time 3, and a composite network of each time point collapsed into one network. Note that team placement in each figure is random, and what information provided by the figures is the amount of relationships that exist for each conflict network.

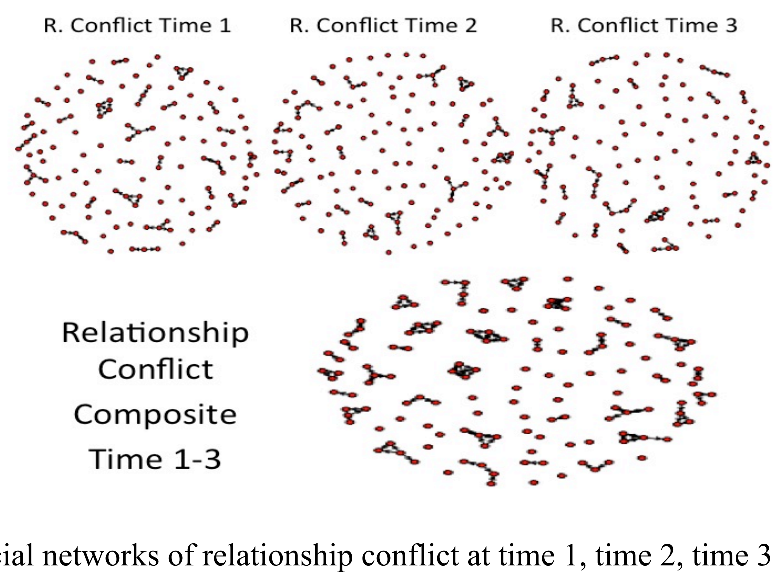

Figure 10. Social networks of relationship conflict at time 1, time 2, time 3, and a composite network of each time point collapsed into one network. Note that team placement in each figure is random, and what information provided by the figures is the amount of relationships that exist for each conflict network.

I tested each hypothesis again with this new composite network using the same analytical methods. Hypotheses 1-3 were not supported with the composite network. The results can be found in Tables 10-12 for Hypothesis 1-3.

Table 10

ERGM results of Teamwork Assembly Mechanisms predicting Composite Task Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 1a Composite (t= 38, n=131, l=128)			
Self-Organizing Principles			
Edge	-1.46***	0.31	0.23
Reciprocity	0.98**	0.33	2.66
Control			
Year	0.16*	0.07	1.17
Main Effect (l=162)			
Compositional Teamwork Assembly	-0.14	0.24	0.87
Hypothesis 1b Composite (t=39, n=141, l=89)			
Self-Organizing Principles			
Edge	-1.19**	0.36	0.30
Reciprocity	2.49***	0.41	12.06
Control			
Year	-0.001	0.008	0.999
Main Effect (l=131)			
Relational Teamwork Assembly	0.10	0.29	1.11

Note. t=number of teams, n=number of individuals, l=number of dyadic connections. * denotes *p*<.05, ** denotes *p*<.01, ***denotes *p*<.001.

Table 11

ERGM results of Taskwork Assembly Mechanisms predicting Composite Relationship Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 2a Composite (t=38, n=131, l=62)			
Self-Organizing Principles			
Edge	-1.19***	0.35	0.30
Reciprocity	0.78*	0.38	2.18
Control			
Year	-0.003	0.08	0.997
Main Effect (l=162)			
Compositional Teamwork Assembly	-0.02	0.26	0.98
Hypothesis 2b Composite (t=39, n=141, l=110)			
Self-Organizing Principles			
Edge	-2.09***	0.31	0.12
Reciprocity	1.82***	0.35	6.17
Control			
Year	0.15*	0.06	1.16
Main Effect(l=131)			
Relational Teamwork Assembly	0.02	0.22	1.02

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes *p*<.05, ** denotes *p*<.01, ***denotes *p*<.001.

Table 12

ERGM results of Taskwork Assembly Mechanisms predicting Relationship Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 3 Composite (t=38, n=131, l=92)			
Self-Organizing Principles			
Edge	-1.18***	0.37	0.31
Reciprocity	0.77*	0.38	2.16
Control			
Year	-0.001	0.08	0.999
Main Effect(l=208)			
Compositional Taskwork Assembly	-0.05	0.25	0.95

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes *p*<.05, ** denotes *p*<.01, ***denotes *p*<.001.

Hypothesis 4a, compositional task assembly mechanisms predicting task conflict overall, was supported with an estimate of 0.63 (p<.001). Hypothesis 4b was not supported with the composite conflict network. The results for Hypothesis 4 can be found in Table 13.

Table 13

ERGM results of Taskwork Assembly Mechanisms predicting Task Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 4a Composite (t=38, n=131, l=77)			
Self-Organizing Principles			
Edge	-1.91***	0.36	0.15
Reciprocity	1.00**	0.33	2.72
Control			
Year	0.15*	0.07	1.16
Main Effect(l=208)			
Compositional Taskwork Assembly	0.62**	0.24	1.86
Hypothesis 4b Composite (t=39, n=141, l=89)			
Self-Organizing Principles			
Edge	-1.58***	0.33	0.21
Reciprocity	1.07***	0.31	2.92
Control			
Year	0.16*	0.06	1.17
Main Effect(l=130)			
Relational Taskwork Assembly	0.16	0.22	1.17

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes p<.05, ** denotes p<.01, ***denotes p<.001.

With the composite conflict networks, the findings for Hypothesis 1-3 did not change, but it does change the interpretation of Hypothesis 4a and 4b. Even though there is a lack of conflict ties present at each time point, combining each time point does not add new information and in this case masks potential relationships.

Supplemental Analysis 2

A second possible reason why many of the hypotheses were not supported is the use of "self-reported" team assembly mechanisms. The current team assembly mechanisms are self-report; characterizing individual's perceptions of what they are attending to when selecting teammates. Teams may assemble in a systematic way that is not reported by the team. Thus, as a supplemental test of these ideas, I used examples of “observed” team assembly mechanisms derived from actual participant characteristics that correspond to each of my four categories (see Table 14).

Table 14
Team Assembly Framework with Observed Mechanisms

Level	Dimension	Definition	Factors Used as the Basis for Team Assembly
Compositional	Taskwork	Choosing teammates based on an individual’s ability to accomplish the team goal	Computing the main effect for individuals reported major categories
	Teamwork	Choosing teammates based on an individual’s ability to positively contribute to group maintenance	Computing the main effect for individuals reported gender and race categories
Relational	Taskwork	Choosing teammates based on previous work or advice relationships	Computing homophily between individuals reported major
	Teamwork	Choosing teammates based on previous relationships	Computing homophily between individuals reported gender and race

Compositional teamwork was assessed using reported gender and race. Compositional taskwork was assessed using reported major. Relational teamwork was assessed using the match between team member’s gender or race. Relational taskwork was assessed using the match between team member’s major. Each hypothesis analysis was run with these added variables using the composite conflict networks. This new analysis requires using different ERGM signatures than what I previously used, edge covariate.

Analyses using compositional mechanisms utilized the node factor signature, whereas analyses using relational mechanisms utilized the node match signature. The node factor signature tests if the different categorical attributes of a node (e.g. gender, race) predict the formation of conflict ties. Node factor counts how often a particular category reports team conflict in my observed data and in the simulated network distribution and then compares those two counts to statistically test if my network is occurring beyond just chance. For example, this will indicate if males or Asians are more or less likely to report team conflict. The node match signature tests if the match between categorical attributes of a node (e.g. gender, race) predicts the formation of conflict ties. Node match counts how often a match between categorical attributes occur and if that match reports team conflict in my observed data and in the simulated network distribution, and then compares those two counts to statistically test if my network is occurring beyond just chance. A positive relationship would indicate that homophily would predict team conflict, whereas a negative relationship would indicate that heterophily would predict team conflict.

Hypothesis 1a states that compositional teamwork assembly mechanisms predict task conflict at the first time point, but for this supplemental analysis I will be using the composite task conflict network. Using the ‘observed’ rather than reported assembly mechanism, I used the nodefactor signature in ERGM to test if the different categories of gender or race in my sample differentially report task conflict. Gender had no significant impact, but race did. The race category “other” has an ERGM effect estimate of 0.43 (p=.02). The odds ratio for this effect is 1.54, meaning that teams consisting of teammates from the “other” race category are 1.5 times more likely to report task conflict.

Hypothesis 1b states that relational teamwork assembly mechanisms predict task conflict at the first time point, but for this supplemental analysis I will be using the composite task conflict network. Using the ‘observed’ rather than reported assembly mechanisms, I used the nodematch ERGM signature to test homophily in terms of gender or race. Neither gender nor ethnicity was significant. The full results for Hypothesis 1 can be seen in Table 15.

Table 15

ERGM results of Observed Teamwork Assembly Mechanisms predicting Task Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 1a Gender (t= 38, n=131, l=128)			
Self-Organizing Principles			
Edge	-1.12***	0.33	0.33
Control			
Year	0.21**	0.08	1.23
Main Effect (l=162)			
Gender=Female	-0.30	0.17	0.74
Hypothesis 1a Race (t= 38, n=131, l=128)			
Self-Organizing Principles			
Edge	-5.68***	0.33	0.003
Control			
Year	0.21**	0.06	1.23
Main Effect (l=162)			
Race=Chinese	-0.15	0.16	0.86
Race=Indian	-0.05	0.17	0.95
Race=Other	0.43*	0.19	1.54
Hypothesis 1b Gender (t=39, n=141, l=89)			
Self-Organizing Principles			
Edge	-1.86	0.35	0.16
Reciprocity	1.74	0.51	5.70
Control			
Year	-0.0001	0.0088	0.9999
Match (l=131)			
Gender	0.35	0.28	1.32
Hypothesis 1b Race (t=39, n=141, l=89)			
Self-Organizing Principles			
Edge	-1.68	0.35	0.19
Reciprocity	1.89	0.47	6.62
Control			
Year	-0.002	0.009	0.998
Match (l=131)			
Race	-0.16	0.27	0.85

Note. t=number of teams, n=number of individuals, l=number of dyadic connections. * denotes $p<.05$, ** denotes $p<.01$, ***denotes $p<.001$.

Hypothesis 2a posits that compositional teamwork assembly mechanisms predict relationship conflict across all phases of the project, but for this supplemental analysis I will be using the composite relationship conflict network. Using the ‘observed’ rather than reported assembly mechanism, I used the nodefactor signature in ERGM to test if the different categories of gender or race in my sample differentially report relationship conflict. Neither gender nor ethnicity was significant.

Hypothesis 2b posits that relational teamwork assembly mechanisms predict relationship conflict across all phases of the project, but for this supplemental analysis I will be using the composite relationship conflict network. Using the ‘observed’ rather than reported assembly mechanisms, I used the nodematch ERGM signature to test homophily in gender or race of the teammates. Neither gender nor ethnicity homophily was significant. The full results for Hypothesis 2 can be seen in Table 16.

Table 16

ERGM results of Observed Teamwork Assembly Mechanisms predicting Relationship Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 2a Gender (t=38, n=131, l=62)			
Self-Organizing Principles			
Edge	-1.06**	0.37	0.35
Control			
Year	-0.01	0.08	0.99
Main Effect (l=162)			
Gender=Female	0.10	0.18	1.11
Hypothesis 2a Ethnicity (t=38, n=131, l=62)			
Self-Organizing Principles			
Edge	-5.37***	0.40	0.005
Control			
Year	-0.01	0.07	0.99
Main Effect (l=162)			
Ethnicity=Chinese	0.29	0.18	1.34
Ethnicity=Indian	-0.12	0.21	0.89
Ethnicity=Other	0.44	0.23	1.55
Hypothesis 2b Gender (t=39, n=141, l=110)			
Self-Organizing Principles			
Edge	-1.01**	0.35	0.36
Reciprocity	0.73*	0.34	2.08
Control			
Year	-0.02	0.07	0.98
Match (l=131)			
Gender	-0.13	0.21	0.88
Hypothesis 2b Ethnicity (t=39, n=141, l=110)			
Self-Organizing Principles			
Edge	-1.13***	0.34	0.32
Reciprocity	0.74*	0.34	2.10
Control			
Year	-0.01	0.07	0.99
Match (l=131)			
Ethnicity	0.07	0.23	1.07

Note. t=number of teams, n=number of individuals, l=number of dyadic connections. * denotes p<.05, ** denotes p<.01, ***denotes p<.001.

Hypothesis 3 states that compositional taskwork assembly mechanisms predict relationship conflict at time one, but for this supplemental analysis I will be using the composite relationship conflict network. Using the 'observed' rather than reported assembly mechanism, I used the nodefactor signature in ERGM to test if the different categories of major in my sample differentially report relationship conflict. Major was not a significant predictor in this analysis. The full results can be seen in Table 17.

Table 17

ERGM results of Observed Taskwork Assembly Mechanisms predicting Relationship Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 3 Major (t=38, n=131, l=92)			
Self-Organizing Principles			
Edge	-5.23***	0.35	0.01
Control			
Year	0.04	0.08	1.04
Main Effect (l=208)			
Major=Engineering	-0.06	0.24	0.94
Major=Social Science	0.16	0.25	1.17
Major=Other	-0.25	0.21	0.78
Major=Double Major (CS/Eng)	-0.15	0.25	0.86

Note. t=number of teams, n=number of individuals, l=number of dyadic connections. ***denotes p<.001.

Hypothesis 4a states that compositional taskwork assembly mechanisms predict task conflict across all phases of the project, but for this supplemental analysis I will be using the composite task conflict network. Using the 'observed' rather than reported assembly mechanism, I used the nodefactor signature in ERGM to test if the different categories of major in my sample differentially report task conflict. Major was not a significant predictor in this analysis.

Hypothesis 4b states that relational taskwork assembly mechanisms predict task conflict across all phases of the project, but for this supplemental analysis I will be using the composite task conflict network. Using the 'observed' rather than reported assembly mechanisms, I used the nodematch ERGM signature to test homophily in major of the teammates. I would expect a negative relationship, which would mean that major heterophily predicts team conflict. Major was not a significant predictor in this analysis. Full results for Hypothesis 4 can be seen in Table 18.

Table 18

ERGM results of Observed Taskwork Assembly Mechanisms predicting Task Conflict

Parameter	Effect Estimate	Standard Error	Odds Ratio
Hypothesis 4a Major (t=38, n=131, l=77)			
Self-Organizing Principles			
Edge	-2.53***	0.40	0.08
Reciprocity	2.13***	0.39	8.41
Control			
Year	0.32***	0.08	1.38
Main Effect (l=208)			
Major=Engineering	-0.05	0.23	0.95
Major=Social Science	0.27	0.25	1.31
Major=Other	-0.09	0.22	0.91
Major=Double Major (CS/Eng)	0.09	0.21	1.09
Hypothesis 4b Major (t=39, n=141, l=89)			
Self-Organizing Principles			
Edge	-1.49***	0.30	0.23
Reciprocity	1.07***	0.31	2.92
Control			
Year	0.15*	0.06	1.16
Match (l=130)			
Major	0.01	0.24	1.01

Note. t=number of teams, n=number of individuals, l=number of dyadic connections.
* denotes $p<.05$, ** denotes $p<.01$, ***denotes $p<.001$.

CHAPTER 5

DISCUSSION

The original and exploratory analysis reveal interesting patterns of relationships between team assembly mechanisms, conflict and team viability. This thesis proposed a conceptual framework for understanding team assembly mechanisms based on the needs of the team to get along and to get ahead: teamwork and taskwork. The premise that these mechanisms affect conflict and viability received mixed support. ***Teamwork*** assembly mechanisms have little impact on team conflict and no impact on team viability. A person consciously choosing a teammate based on team harmony seemed to have no effect on the conflict experienced by the team or how viable the team was for future projects. Self-reported teamwork assembly mechanism network did not impact task or relationship conflict, but observed team assembly mechanisms did impact task conflict. ***Taskwork*** assembly mechanisms impact team conflict, but not team viability. Unlike the teamwork assembly mechanism finding, self-reported taskwork assembly mechanism predicted task conflict but the observed team assembly mechanisms did not. Individuals who knowingly chose others based on project-related attributes were more likely to experience task conflict at some point in the team's life.

Teamwork assembly mechanisms did not impact team conflict in the way I had hypothesized. Knowingly choosing individuals in a way that promoted team harmony did not appear to have lasting effects for team conflict or viability. The observed compositional teamwork assembly did impact a team's experiencing of task conflict. Teams with members belonging to the 'other' race category, essentially the minority category of the sample, were 1.5 times more likely to report task conflict. This finding highlights that perceived assembly mechanisms and observed assembly mechanisms may not lead to the same result. Previous team assembly research generally focused on the observed mechanisms (Cummings & Kiesler, 2007; Hinds et al., 2000) and as shown by this thesis, it is possible that observed mechanisms impact team functioning. While perceived teamwork assembly mechanisms did not impact conflict, observed mechanisms did. More work is needed to understand the interplay between observed and perceived teamwork assembly mechanisms.

The lack of findings with perceived teamwork assembly mechanisms could be due to theoretical and methodological issues. A basic assumption of my hypotheses is that teamwork assembly mechanisms would have lasting impact on team process and behavior, in particular team conflict. This idea stems from team diversity literature, where the 'inputs' of a team impact team processes and outcomes throughout a teams life (Barrick et al., 1998; Bell, 2007; Bowers et al., 2000 Ilgen et al., 2005; Mathieu et al., 2014). Based on this study's results, that logic does not hold up. Teamwork assembly mechanisms do not have a lasting impact to shape team conflict. I hesitate to extend that statement beyond team conflict because other processes were not examined. Teamwork assembly mechanisms are used to promote team harmony and social functioning. It is tenable that teamwork assembly mechanisms impact other team constructs that increase positive interpersonal relations within the team.

Methodological issues could contribute to my lack of findings with teamwork assembly mechanisms. As shown in Figure 4, overall individuals did not endorse many teamwork assembly mechanisms as a reason for choosing a teammate. The average number of endorsements was 1.76 out of a possible of 11, with a great deal of individuals not using the mechanism to select teammates. This result could be explained in three ways: Individuals were apathetic towards using teamwork based mechanisms for choosing teammates; individuals did not wish to disclose using such mechanisms; or the questionnaire does not properly capture important aspects of teamwork assembly mechanisms. Teammates can be chosen for any reason, and this sample may have consciously used taskwork assembly mechanisms without regard to teamwork assembly mechanisms. Many of the teamwork assembly items referred to personal attributes (race, gender, nationality) that individuals may be uncomfortable responding about. By acknowledging using those mechanisms, individuals might feel it makes them appear discriminatory towards certain races, gender or nationality. Finally, the teamwork assembly items may not capture all of the factors of individuals that promote team harmony within this setting.

Taskwork assembly mechanisms did impact team conflict. Both compositional and relational taskwork mechanisms predicted task conflict at some point in the team's life. When individuals consciously chose teammates based on their project-related knowledge, skills or abilities, those individuals were more likely to engage in project disagreements. Unlike with teamwork assembly mechanisms, perceived taskwork assembly mechanisms predicted team conflict but not observed taskwork assembly mechanisms. This result gives evidence for a need to look beyond just observed team assembly mechanisms and also consider why individuals believe they chose a teammate. Both perceived and observed assembly mechanisms provide different insights into self-assembled teams. In this case, when teammates perceived choosing others for task-related reasoning's they engaged in task conflict. Whether or not the team actually consisted of individuals with different project-related abilities didn't affect task conflict. Thus depending on using a perceived assembly mechanism or observed assembly mechanism lens, different results occur in regard to team conflict.

The lack of findings with taskwork assembly mechanisms at all time intervals points out how *taskwork* assembly mechanisms could impact team process at different points within a team's life. Compositional taskwork assembly mechanisms increased the likelihood of teammates experiencing task conflict at the project mid-point, but not the beginning or end. An explanation for this is that the differences in project-related abilities become relevant at the project mid-point, but not the beginning of the project. While project-related abilities would remain salient towards the end of the project, team members may have resolved the conflict by the end. Relational taskwork assembly mechanisms increased the likelihood of teammates experiencing task conflict at the end of the project, but not the beginning or the mid-point. It is possible that by the end of the project some advice relationships were created or dissolved. Balkundi, Barsness, and Michael (2009) found that teams with leaders who had advice ties with some subordinates but not others lead to increased team conflict. That idea could extend here, in that those who were sought after for advice were in a leadership position, but as relations change the potential for team conflict rises.

Additionally, methodological issues could contribute to my lack of findings with taskwork assembly mechanisms. As shown in Figure 5, there is a decent distribution of endorsements of taskwork assembly mechanisms, with a slight positive skew. The average number of endorsements was 4.9 out of a possible of 12. Unfortunately, there were an extremely high number of individuals who do not report endorsing taskwork assembly mechanisms. With network measures, a lack of an answer is not assumed as a person skipping the question, but rather as not endorsing that particular item. Thus it becomes difficult to tell if respondents were skipping these questions or honestly not endorsing the questions.

Relational assembly mechanisms (taskwork or teamwork) were not found to predict team viability. This is surprising considering these are relationships that existed before the team was formed but they did not predict the likelihood of these teammates working together in the future. There are both substantive and methodological reasons why this might be the case. This thesis did not take into account the potential dissolution of advice or friend relationships over the course of the project. Thus the relationships held at the beginning of the project that influenced member selection may have changed. The new pattern of relationships at the end of the project would influence the likelihood of the team working together again. Thus, the current relationships between individuals influence teammate selection, not necessarily past or future relationships.

The lack of findings may also stem from methodology, owing to either the lack of range in viability responses, or the lack of ties within the taskwork and teamwork networks. Figure 6 and 7 shows the networks for the relational and the compositional mechanisms, and Table 19 shows the average density within these networks.

Table 19

Descriptives of Conflict and Assembly Networks

Variable	Average Density	Range
Task Conflict Time 1	0.27	0-1.0
Task Conflict Time 2	0.26	0-0.67
Task Conflict Time 3	0.23	0-1.0
Relationship Conflict Time 1	0.19	0-1.0
Relationship Conflict Time 2	0.16	0-0.83
Relationship Conflict Time 3	0.14	0-0.42
Compositional Task Assembly	0.61	0-1.0
Compositional Team Assembly	0.44	0-1.0
Relational Task Assembly	0.17	0-0.58
Relational Team Assembly	0.14	0-0.33

Note. Density is a proportion of the number of ties in a network with the total number of ties possible.

Visually the relational networks and the compositional networks vary greatly, with much more ties being present in the compositional networks. Additionally, the average densities for the relational mechanisms networks were much lower than those of the compositional mechanism networks. This highlights a potential issue conducting network-based teams research. While the sample size for this thesis was acceptable for teams research or networks research, it may be too small for team network research. Not all ties within a team network are possible, and theoretically they shouldn’t be, but the lack of ties in each team may prevent analysis from detecting relationships.

This thesis opens up a relatively new line of inquiry in team formation: how do team assembly choices impact team functioning and effectiveness? Much can be built from this study to improve several domains of team research, such as conflict and formation. Research on team formation of self-assembled teams has received attention from diverse fields in diverse venues (e-science conference, Organizational Behavior and Human Decision Processes, Open Source Systems, Science). To better digest findings regarding team assembly mechanisms, the science of team assembly would benefit from utilizing the framework developed in this thesis in future research. Researchers propose varying mechanisms that relate to promoting team harmony or achieving the team goal (e.g. homophily, competence, previous relationships; Casciaro & Lobo, 2008; Hahn et al., 2006; Hinds et al., 2000). Having a taskwork vs. teamwork structure imposed would allow for better explanation of team assembly mechanisms rather than proposing a myriad of mechanisms, which may not have obvious connections with other mechanisms across studies.

Team assembly literature also lacks an understanding of why a person believes they choose another as a teammate, though some work has been done on this front (Pinto, 2008). The mechanisms people believed they were choosing others as teammates could be better understood. With the proposed framework as a guide, researchers can explore in depth the perceptions of teammate choices. It is possible that different team contexts encourage different assembly mechanisms. With virtual, open source software teams, relational mechanisms were the only predictors of team formation (Hahn et al., 2006). Findings from one team assembly study may not extend to other studies simply because of the team context, but this has yet to be explored in team assembly research.

Unlike previous team assembly research, this study examined both the perceived mechanisms for team assembly as well as the observed assembly mechanisms. Results indicated that perceived and observed assembly mechanisms lead to different results. It is important to understand how the two interact, how a team perceives forming in one way but actually forms in another. Perhaps a team believed they assembled based on compositional taskwork assembly mechanisms only, but happened to also pick teammates that were homopholous in race and gender. This disparity may or may not be intentional, and thus warrants future research. The distortions between perception and reality could be considered a team assembly bias, where individuals believe (or report) assembling in one way, but the resultant team composition suggests other assembly factors at play. The bias could be due to an implicit bias reasoning (not realizing he/she is using other mechanisms) or social desirability (not wanting to report using other mechanisms).

Team assembly literature also lacks an understanding of how team assembly mechanisms impact team functioning. Much of the focus is on team performance rather than functioning (Guimera et al., 2005; Hinds et al., 2000). Despite the majority of relationships between team assembly mechanism and team conflict were not significant in this study, it is a step in the right direction to move team assembly and team conflict research forward. Conflict has yet to be studied sociometrically in team's literature and the current study provides interesting insights as to how conflict is reported. Based on my sample, it would seem that conflict rarely happens within these teams but this may not be the case if I measured team conflict psychometrically. The nature of team conflict could be more fully explored with a comparison of the traditional methodology (psychometrics) with patterning of conflict relationships (sociometric). This could help put this thesis into perspective and enlighten future research on team conflict.

Theoretical Contributions

This thesis contributes to the science of teams by providing a model of team assembly grounded in relevant psychological and network science theories. Understanding the self-formation of self-designed teams is a unique and understudied phenomena in current teams research. In fact, the majority of experimental studies randomly assign members to a team in an effort to control for extraneous variance (Shadish, Cook, Campbell, 2002). This common research practice fails to capture the resulting dynamics in teams where members have agency in deciding whom to work with. This thesis affords an understanding of how teammate selection decisions affect resulting conflict ties within teams. Thus, this study is one step forward for team assembly research and provides a model that future researchers can utilize. Previous team assembly literature focuses only on the mechanisms of team assembly, but not how those decisions can impact a team. Despite the prevalence of conflict and viability in teams literature, researchers have not considered the process of team formation affecting those constructs. This thesis takes the necessary step of bridging a relatively new area of network-focused research, team assembly, with a popular team research area, conflict and viability. The current findings are promising but require further research to truly understand the complex relationships among self-selected teammates and team functioning.

Practical Contributions

This thesis also holds the potential of benefiting the practice of using teams. Teams are frequently used in organizations in a variety of ways. Currently there are many ways teams are formed in organizations, from self-selected to appointed team memberships. Employer's benefit from understanding what factors might cause teams to function or fail. With the differences in how a team is formed, organizations would benefit from knowing the implications of allowing teams to self-select. Employees may need to be encouraged to select teammates for specific reasons or not allow self-selection to occur if the situation is not appropriate. The current knowledge base of self-designed teams leaves many questions to be answered that are of value to employers. This thesis advances the knowledge of self-designed teams for the benefit of employers and scientists.

Outside of the workplace, this thesis has implications for class-based teams. Team projects are highly prevalent in all levels of the education system. Allowing students to select their own teammates could be representative of what they can expect in the workplace. This study provides a deeper understanding what reasoning students use to select teammates, at least for Master's level students. Instructors could use this information to guide students in the teammate selection process, as well as help develop systems that students could utilize to select teammates.

Limitations

As with all research, this study is not without limitations. One limitation is sample size. A post-hoc power analysis for the regression results of hypotheses five and six revealed that it did indeed lack sufficient power (d=.06). In order to detect the effect size (80% chance) of the viability regression at significance level of 5%, I would need a sample size of 1395 teams. This sample size need is largely a function of the small effect size found in this study. An open question is the extent to which the observed effect size is indicative of the true effect.

The sample size for the ERGM equations did not appear to be an issue. Whereas the regression equation relies on the team-level sample size, the ERGM equations rely on dyad-level sample size. The equivalent of a power analysis for an ERGM would be to examine the Markov Chain Monte Carlo (MCMC) diagnostics. This function creates diagnostic plots for the MCMC sampled statistics produced from the fit of the equation.

These plots need to have an approximately normal distribution and centered around zero. Each ERGM analysis had adequate fit according to the MCMC diagnostics.

A second limitation was the setting and sample. This was a class-based sample spread across three semesters. Variance can be introduced by having three separate sample measurements, as evidenced by some of the significant findings with the control variable year in the ERGM equations. Despite the intensity of the class project, it was still a class assignment. The generalizability of the results to a working population must be taken with caution. There are some similarities between this sample and the workplace. For example, within an organization and within the class, there is a 'closed' network of individuals to select from. Individuals cannot select anyone to be on their team, but only people within the organization (or class). This can limit the knowledge and resources available for individuals to select teams. These were graduate-level students and it can be assumed that these are expert students within their knowledge base. Additionally, the class-project was representative of the type of work many of the students would be engaged in at their future job.

A third limitation is measurement. This thesis is a first, albeit imperfect, step into a new way to understand psychological concepts within a network perspective. Generally, network measurement is done via one item. To create the compositional assembly mechanism networks, multiple sociometric items were used. This unprecedented way of measuring a network is bound to have imperfections. Psychometric theories allow for binary and dependent items in a scale to be assessed to ensure proper measurement, though there is no known research involving network items. Also, there is no precedent on the best way to dichotomize such data. Conflict networks were measured via one-item network measure, but this is not something commonly practiced in team conflict research. Condensing a 5+-item scale into one item means a loss of information and nuance within the construct. Measuring conflict sociometrically provides potentially different findings and information than measuring conflict psychometrically.

Future Directions

Future research on team assembly should take my limitations as a platform for new studies. Current psychometric methods are adequate for using multiple sociometric items to capture latent variables, but it is possible sociometric items do not behave similarly to psychometric items. A deeper understanding of measuring latent variables with sociometric items could open doors for new ways to conceptualize not only teams but also social psychological research. Additionally, the differences between sociometric and psychometric measures of team conflict should be explored. Sociometric data provides a more complete picture of the pattern of conflict and the extent of conflict within a team, but the salience of signaling out particular team members may influence responses. Network measurement is useful for leadership and communication studies (Carson, Tesluk, & Marrone, 2007; Leenders, van Engelen, & Kratzer, 2003), but perhaps the negativity of conflict makes network measurement more difficult.

There are many ways to expand team assembly research and, in general, team network research. Much more research is needed to understand the relationship between team assembly and team functioning. Team conflict is a team behavior that can occur at any time, but other factors influence team conflict (e.g. team identity, Mortensen & Hinds, 2001; trust, Curseu & Schruijer, 2010). Moderators may be necessary to understand relationships between team assembly mechanisms and more distal team interactions such as conflict. Team assembly mechanisms may have a more robust relationship with team processes closely related to that mechanism. For example, choosing teammates to create greater team harmony may lead to early development of trust or identity. Or using taskwork assembly mechanisms may help or hinder the development of shared mental models.

Future directions of team viability research could take on a network perspective. Viability is another team construct that would benefit from being assessed sociometrically. It's possible that individuals are interested in working with only certain teammates again, but not others. By not assessing at the network level, information is loss about the exact patterning of viable relationships. Measuring team viability sociometrically would allow for additional and complex relationships with other network variables to be assessed.

Team assembly research needs to address the potential differences between measuring 'perceived' team assembly mechanisms and 'observed' assembly mechanisms, and the impact of both types of mechanisms on team functioning and performance. Much of the current research revolves around 'observed' assembly mechanisms and how those mechanisms influence team performance. Those findings are useful for understanding how individuals may be unknowingly systematically selecting individuals as teammates and the consequence of that selection on performance, but we also need to know the implications of how individuals believe they are selecting individuals and that impact on performance. This thesis did not address team performance with regard to 'perceived' or 'observed assembly mechanisms, but future research can.

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